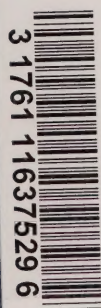


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GOVT PUBNS

Canada ^{Commissioners and Assess} Commission
Appointed to Delimit the
Boundary Between the
Provinces of Alberta and
British Columbia.
Report

GOVT PUBNS



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Canada. Boundary Between the Provinces of
" Alberta and British Columbia, Commission
appointed to delimit the

Commissioners

R. W. Cautley, D.L.S., A.L.S.
For the Dominion of Canada and the Province of Alberta
A. O. Wheeler, D.L.S., B.C.L.S.
For the Province of British Columbia

Report of the Commission
Appointed to Delimit the Boundary
between the Provinces of
Alberta and British Columbia

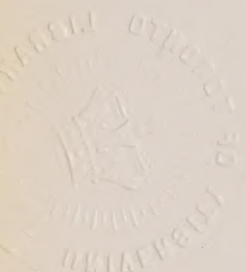
Parts III-A and III-B

1918 to 1924

From Yellowhead Pass Northerly

Office of the Surveyor General
Ottawa, 1925

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OTTAWA
F. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1928

BANFF, August 4th, 1925.

TO THE HON. CHARLES STEWART, M.P., MINISTER OF THE INTERIOR, OTTAWA,
THE HON. ALEX. ROSS, M.P.P., MINISTER OF PUBLIC WORKS, EDMONTON,
THE HON. T. D. PATIULLO, M.P.P., MINISTER OF LANDS, VICTORIA.

Your Commissioners, R. W. Cautley, D.L.S. and A.L.S., representing the Dominion and Alberta Governments, and A. O. Wheeler, D.L.S. and B.C.L.S., representing the Government of the Province of British Columbia, have the honour to submit herewith Part III of the Report of the Commission.

Part I of the Report deals with the operations of the Commission from the International Boundary to Kicking Horse Pass, and was published in 1917. Part II deals with the operations of the Commission from Kicking Horse Pass to Yellowhead Pass, and was published in 1924. Part III is in two sections, Part III-A dealing with the operations of the Commission from Yellowhead Pass to the intersection of the summit of the Rocky Mountains with the 120th meridian, and Part III-B covering the operations of the Commission along the 120th meridian from its intersection with the summit of the Rocky mountains to the northerly terminal of the surveyed boundary, in latitude $57^{\circ} 26' 39''$.

The survey of the Alberta-British Columbia boundary has been carried on continuously since the appointment of the Commission in 1913. It is pleasant to be able to record that your Commissioners have at all times felt the fullest confidence in one another and have worked together in the greatest harmony.

Your Commissioners desire to express their very sincere appreciation of the interest and sympathetic consideration which has been given to their work by the chiefs of the Topographical Survey Branch of Canada. The work was organized in the first place under the direction of the late Dr. Deville, I.S.O., LL.D., D.T.S., F.R.S.C., Surveyor General of Canada, who died while the survey of the last pass was actually in progress. Both your Commissioners worked for the greater part of their professional careers under Dr. Deville and know, in common with all other surveyors, that the mark of his wonderful personality can never be effaced from the splendid system of Canadian surveys for which he did so much to lay the foundation and to perfect.

Accompanying Part III of the Report is an atlas of 30 maps, of which sheets Nos. 29 to 37 inclusive belong to section A and Nos. 38 to 54 inclusive belong to section B of Part III.

R. W. CAUTLEY,
ARTHUR O. WHEELER, } *Commissioners.*

CONTENTS

PART A

Chapter	PAGE
I Topographical Surveys Executed in 1922.....	1
Description of Operations.....	1
Exploration in 1921.....	7
Miette Pass.....	9
South Passage.....	9
Centre Passage.....	9
North Passage.....	9
Grant Pass.....	10
Colonel Pass.....	11
Moose Pass.....	13
Robson Pass.....	15
Bess Pass.....	20
Carcajou Pass.....	22
General Remarks.....	24
Watershed.....	24
Trails.....	27
Rivers and Streams.....	28
Timber.....	30
Game and Fish.....	30
Maps.....	31
II Topographical Surveys Executed in 1923.....	33
Geodetic Survey Triangulation.....	33
Description of Operations.....	33
Carcajou Pass.....	36
Bess Pass.....	36
Jackpine Pass.....	36
Jackpine River Valley.....	38
Loren Lake Pass.....	39
Beaverdam Pass.....	40
Avalanche Pass.....	41
Morkill Pass.....	42
General Remarks.....	43
Watershed.....	43
Trails.....	50
Rivers and Streams.....	52
Timber.....	53
Game and Fish.....	54
Maps.....	55

Chapter	PAGE
III Topographical Surveys Executed in 1924.....	57
Geodetic Survey Triangulation.....	58
Topographical Division—Description of Operations.....	58
Fetherstonhaugh and Forgetmenot Passes.....	59
Casket Pass.....	61
Sheep Pass.....	62
Cecilia Lake.....	64
Cote Creek.....	65
Kakwa Pass and Lake.....	65
Jarvis Pass.....	66
Kakwa River Valley.....	67
North of Kakwa Valley.....	68
General Remarks.....	70
Watershed.....	70
Trails.....	71
Rivers and Streams.....	72
Timber.....	72
Game and Fish.....	72
Maps.....	74
Robson Pass.....	74
Boundary Line.....	75
Miette Pass.....	75
Boundary Line.....	76
Memorial Monument.....	77

PART B

I The Meridian Section of the Boundary.....	83
Necessity for Survey of 120th Meridian.....	84
Apportionment of Work between Commissioners.....	85
Establishment of Longitude Pier at Pouce Coupe.....	86
II Conferences of Representatives. Instructions.....	89
Methods of Survey. Boundary Monuments.....	89
Conference of 1921.....	89
Conference of 1924.....	90
Instructions.....	90
Methods of Survey.....	91
Direction of Line.....	92
Measurement of Distances.....	92
Levelling.....	93
Line Cutting.....	93
Magnetic Declination.....	94
Connections with Previous Surveys.....	94
Boundary Monuments.....	94
Concrete and Secondary Type Monuments.....	97
Marking of Monuments.....	97
Photographs.....	98
Triangulation Methods in Mountain Section of 120th Meridian.....	98

Chapter	PAGE
III Chronological Progress of the Survey of 120th Meridian.....	99
Season of 1918.....	99
Fort St. John Wagon Road.....	99
Establishment of Initial Point on 120th Meridian.....	100
Season of 1919.....	101
Peace River.....	103
Season of 1920.....	104
Season of 1922.....	108
Placing of Caches.....	109
Field Work.....	110
General Description of Country.....	114
Season of 1923.....	116
Field Work.....	116
General Description of Country.....	119
Season of 1924.....	124
Field Work.....	124
Survey of 120th Meridian.....	124
Triangulation Survey.....	125
Connection with 16th Base Line.....	127
Trigonometrical Levelling.....	127
General Description of Country.....	127
IV Description of Country by Townships.....	131
Township 62.....	131
" 63.....	134
" 64.....	136
" 65.....	137
" 66.....	139
" 67.....	141
" 68.....	142
" 69.....	143
" 70.....	144
" 71.....	145
" 72.....	146
" 73.....	147
" 74.....	148
" 75.....	149
" 76.....	150
" 77.....	151
" 78.....	152
" 79.....	153
" 80.....	155
" 81.....	156
" 82.....	156
" 83.....	158
" 84.....	159
" 85.....	160
" 86.....	161
" 87.....	162
" 88.....	163
" 89.....	164
" 90.....	165

IV	Description of Country by Townships— <i>Concluded</i>	PAGE
	Township 91.....	165
	“ 92.....	166
	“ 93.....	167
	“ 94.....	167
	“ 95.....	168
	“ 96.....	168
	“ 97.....	169
Appendix I—		
	Report on the Survey of the Interprovincial Boundary between Alberta and British Columbia at Phillipps Pass.....	171
	Map Showing Completion of the Survey of Phillipps Pass.....	172
Appendix II—		
	Description of Brass Bolts and Cairns Placed to Mark the Line of the Watershed..	
	Miette Pass.....	173
	Robson Pass.....	173
Appendix III—		
	Table of Latitudes and Departures Referring Brass Bolts and Cairns to nearest Boundary Monument.....	175
Appendix IV—		
	List of All Monuments Established to Mark the Interprovincial Boundary between Alberta and British Columbia Along the 120th Meridian.....	177
Appendix V—		
	Views of Monuments.....	183
	Crowsnest Pass.....	183
	Robson Pass.....	183
	Miette Pass.....	184
	120th Meridian.....	185

LIST OF ILLUSTRATIONS

PART A

	Page
Northeast Face of Mt. Robson (aerial photo by H. F. Lambart).....	3
Mt. Sir Alexander, S. Face (aerial photo by H. F. Lambart).....	4
Mt. Sir Alexander, E. Face (aerial photo by H. F. Lambart).....	4
Miette Pass—South Passage.....	7
Miette Pass—Centre Passage.....	8
Miette Pass and Grant Pass.....	9
Summit of Grant Pass.....	10
Summit of Colonel Pass.....	12
Miette River Valley—Looking Southeast.....	13
The Colonel.....	14
Summit of Moose Pass.....	15
Northeast Face of Mt. Robson, Berg Lake and Lake Adolphus (aerial photo by H. F. Lambart).....	16
The Emperor Falls, Head of Valley of a Thousand Falls.....	17
South Face of Mt. Robson.....	19
Summit of Bess Pass.....	20
Mt. Chown (aerial photo by H. F. Lambart).....	21
Mt. Bess and Mt. Chown.....	22
Mt. Chown and Chown Glacier.....	23
Valley of Carcajou Creek and Mt. Phillips.....	24
Lynx Mountain—N. Face.....	25
The Coleman Glacier and E. Face of Mt. Robson.....	26
Glaciers at the Head of Resplendent Valley.....	29
Morass at Summit of Carcajou Pass.....	35
Jackpine Pass.....	37
Mt. Chown and Chown Glacier.....	38
Swampy Meadows in Jackpine River Valley.....	39
Jackpine River Valley below the Bend.....	40
Loren Lake Pass.....	41
Loren Lake and Pass.....	42
Beaverdam Pass.....	43
Morkill Pass.....	44
Glacial Cirque at Head of Holmes River and Carcajou Creek—Panorama.....	46-47
Icefields and Glaciers at Head of Holmes River and Carcajou Creek—Panorama.....	48-49
Northern Half of Resthaven Icefield—Panorama.....	50-51
Southern Half of Resthaven Icefield—Panorama.....	52-53
Fetherstonhaugh Pass.....	59
Forgetmenot Pass.....	60
Valley of Casket Pass.....	61
Sheep Creek Valley and Sheep Pass.....	62
Valley of Sheep Creek—Looking East.....	63
Mt. Sir Alexander and Mt. Buchanan.....	65

LIST OF ILLUSTRATIONS—*Concluded*PART A—*Concluded*

	Page
Kakwa Pass and Lake.....	66
Kakwa Lake and Pass.....	67
Kakwa Lake and Pass.....	68
Kakwa Valley and Jarvis Pass.....	69
Kakwa River and Valley.....	70
Mt. Torrens and Valley of Saxon Creek.....	71
Mt. Torrens after a Snowstorm, Looking Northwest.....	72
Shale Hills, Showing Formation.....	73
Showing Plateau Lands North of the Mountains.....	74
Memorial Monument Erected in Robson Pass.....	78

PART B

Longitude Pier at Pouce Coupe in 1917 by F. A. McDiarmid.....	88
Diagrams of Special Post and Mound.....	95-96
Village of Pouce Coupe in 1918.....	100
Johnson Farm on Northeast Quarter-Section 10, 72-10-6.....	101
Survey Outfit Rafting Down Peace River.....	103
Cutting the Line on 120th Meridian in Tp. 68.....	105
Cutting the Line on 120th Meridian in Tp. 68.....	106
Redwillow River at the Boundary Crossing.....	108
Wapiti River Upstream from Crossing of Calahoo Trail.....	111
B-13 in Action.....	112
Swimming Horses Across the Wapiti.....	113
Fording Narraway River.....	116
Cairn on Summit of Torrens.....	117
Monument 88-3 on Summit of Clear Hills.....	120
Doig River Looking Upstream from the Boundary.....	121
Chinchaja River Looking Downstream Near Boundary.....	122
Most Southerly Concrete Monument.....	132
Line Looking North across the Wapiti River.....	133
Valley of Narraway River—Panorama.....	135
Wapiti River North from Monument 66-2.....	140
Pouce Coupe River Upstream from Boundary.....	151
Map Showing Completed Survey of Phillips Pass.....	172
Cairn on the Summit of Torrens.....	182

VIEWS OF MONUMENTS

	PAGE
Phillips Pass.....	183
Robson Pass.....	183
Miette Pass.....	184
One Hundred and Twentieth Meridian.....	185

Part III-A

TOPOGRAPHICAL SURVEYS

OF

THE WATERSHED

1922, 1923, 1924

CHAPTER I

TOPOGRAPHICAL SURVEYS EXECUTED IN 1922

DESCRIPTION OF OPERATIONS

The Topographical division made the usual tests of cameras for verticality and speed of plates on the course laid out at Banff. The party then organized at Jasper and, on July 2nd, proceeded to Yellowhead Pass and picked up the work where it had been discontinued in 1917.

North of Yellowhead Pass there is no possibility of making a tie with the Dominion Lands system of survey until the 120th meridian as surveyed south by Mr. Cautley's division, is reached. Arrangements, therefore, had been made with the Geodetic Survey of Canada by which it was planned to extend a system of triangulation from Yellowhead Pass to connect with the 120th meridian at the point where it first intersected the watershed of the Rocky Mountains on its southward course.

The work was placed in charge of Mr. H. F. Lambart, D.L.S., of the Geodetic Survey, who met Mr. Wheeler at Banff on June 2nd and arranged a plan of action.

Mr. Lambart organized a party at Jasper early in June and commenced work, using as an initial base Mr. Cautley's monumented survey across the summit of Yellowhead Pass, made in 1917.

His triangulation work of the past season was chiefly reconnaissance, consisting of the selection of suitable stations for the quadrilaterals of the triangulation, also the securing of necessary information for the measurement of a base on Yellowhead Lake the following winter and the final reading of angles at the stations selected.

This work was carried on until the end of August and the system was extended for nearly one hundred miles northwesterly from Yellowhead Pass to within sight of Mt. Sir Alexander, the outstanding massif close by Jarvis Pass. Owing to an unusually dry season, bush fire smoke was very prevalent throughout the summer and proved highly detrimental to the work in hand. Notwithstanding, Mr. Lambart made good progress and established some twenty-three stations. This triangulation, extending along the main divide of the Rocky Mountains, has been of very great service in providing a tie between the Dominion Lands system of surveys at Yellowhead Pass and those in the Peace River district, and in accurately locating the camera stations of the Boundary Survey.

Arrangements had been made with the Royal Canadian Air Force to assist Mr. Lambart in his work, and facilities were extended to Mr. Wheeler for a reconnaissance flight over the region of the watershed from Yellowhead Pass to Jarvis Pass, with the object of ascertaining the nature of the country to be covered by the Topographical division in its progress northward.

On July 11th an aeroplane from the Air Service Station at High River, Alberta, arrived at the landing at Henry House, situated between the Canadian National Railway and the Athabaska River, some ten miles north of Jasper. The machine was piloted by Captain J. H. Tudhope of the Royal Canadian Air Force.

On the 12th, the Superintendent of Jasper Park, Colonel S. M. Rogers, motored Mr. Wheeler to the landing place and he was taken by Captain Tudhope for an initial flight in order to get an insight into the method of observing from an aeroplane. It was a first experience and, to one who had been making maps for the best part of a lifetime, it was a revelation to gaze from so exalted a viewpoint upon Nature's map as it unfolded beneath in a slowly moving panorama, for such was the impression received although the viewpoint itself was travelling at a speed of eighty miles an hour.

The 13th broke cloudy and was by no means a suitable day for a venture into the heart of the mountain wilderness. However, as time was an object, and the next day might be no better, it was decided to start. The capacity of the machine was about four hours and the distance to be travelled some three hundred miles. The course followed the Miette River valley to the Colonel Mountain, then Moose Pass, Smoky River valley, Bess Pass, Jackpine Pass and Jackpine River Valley. North of this the clouds were rolling over the divide and, as a result of frequently having to edge away from them, a wrong divide was followed which brought in view the Fraser River Valley, far to the westward of the watershed. An attempt was made to get on a right course but the clouds were getting lower and travelling was becoming more dangerous, owing to the close mountain surroundings. After beating about for some time hoping to find a known landmark, Captain Tudhope decided to return to the Fraser Valley and effect a landing. This was done near McBride, 120 miles from the starting point. Gasolene was procured here and a return flight made up the Fraser Valley at an altitude of 8000 feet. It was a serious matter to be practically lost amidst the clouds when all known mountain landmarks were hidden in them, but the competent skill and good judgment of Captain Tudhope brought the flight to a safe ending. Some useful knowledge was obtained which prevented loss of time in the conduct of the survey work.

On July 16th Captain Tudhope took Mr. Lambart for a most successful flight over the watershed all the way from Mount Robson to Jarvis Pass, close to the supposed intersection of the 120th meridian with the watershed. The flight was made under perfect weather conditions and the return completed in a little less than four hours. A number of very fine aerial photographs were obtained by Mr. Lambart. Specially fine were those of Mt. Robson and

Mt. Sir Alexander and of another very striking, sharp-pointed peak, named Mt. Ida,* rising directly above Jarvis Pass. Jarvis Pass was identified by the chain of lakes at its summit. Some of the views obtained have been of considerable use to the Topographical division in connection with its map work.

Concerning the flight Mr. Lambart writes: "Mt. Sir Alexander will never be climbed. It is an absolute knife-edge of snow, not even corniced along its full length. It is surrounded by a high-level icefield, the best approach to which is from the north. The only possible attempt at an ascent is from the east side. I have photographs looking straight down on the peak. Mt. Ida*,

Robson Cirque and Glacier
Resplendent Mtn. : Rearguard The Helmet



NORTHEAST FACE, MT. ROBSON—12,972 FEET ALTITUDE

Aerial photograph by H. F. Lambart

only a few miles away, is another Matterhorn of the Canadian Rockies and is much lower than Mt. Sir Alexander. The mountains and wide open valleys north of Mt. Bess are easy, and the timber seems particularly vigorous. North of Jarvis Pass the country is not excessively high, and the snow and ice-covered mountains from here on seem to swing distinctly more to the westward."

In 1917 the survey had been carried north of Yellowhead Pass to the basin at the head of Rink Brook and now access was obtained to the area beyond by means of the firewardens' trail from the cabins at the summit of the pass, for the few miles it had been cut out, to the north crest of the valley of Rink Brook.

*The name Mt. Ida is not yet confirmed by the Geographic Board of Canada. There is now the confirmed name, Mt. Ida in Kamloops district.



MT. SIR ALEXANDER (MACKENZIE) SOUTH FACE. GLACIERS AT SOURCE OF MCGREGOR RIVER

Aerial photograph by H. F. Lambart



MT. SIR ALEXANDER—EAST FACE

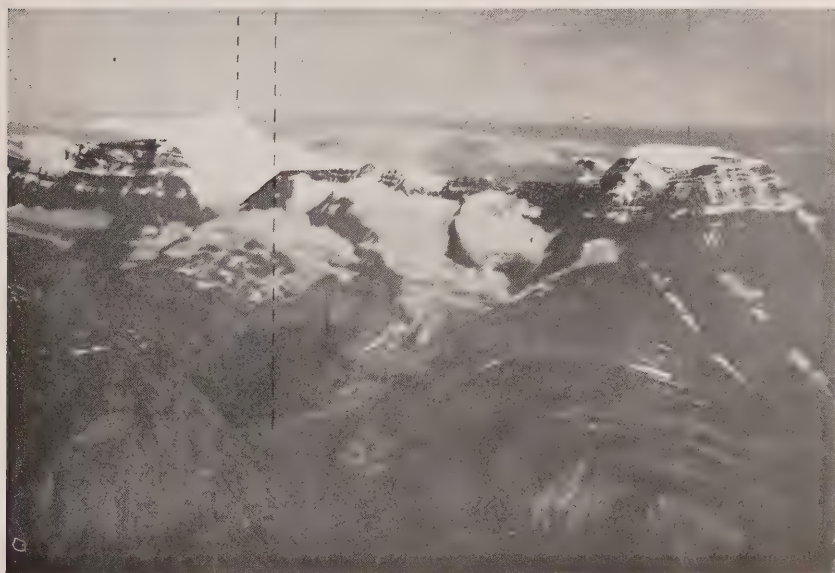
Aerial photograph by H. F. Lambart

Beyond this, progress was made by following along the western slopes of the Miette Valley to the watershed, picking the best possible route through the timber. It was not good going, rocks and boggy spots being encountered frequently, but at length the timber opened to grassy alplands, which led over the watershed. Here is a pass with three distinct passages leading across the Divide from the valley of Miette River to that of Grant Brook. It is referred to as Miette Pass.

To cover the vicinity eight camera stations were occupied between July 9th and 25th. At the end of the 1921 season Mr. A. J. Campbell, D.L.S.,

Jackpine Pass
Mt. Chown

Mt. Bess



MT. BESS (10,550 FEET) AND MT. CHOWN (10,930 FEET)

assistant on the party, had been sent to explore the area now surveyed. He then occupied three stations which have been incorporated.

Some four miles northwest of Miette Pass, at the head of Grant Brook, is another crossing of the watershed which is referred to as Grant Pass. The flow northeasterly, on the Alberta side, is a head of Snaring River.* Two miles north of Grant Pass summit there is still another crossing of the watershed which leads to the headwaters of Colonel Creek, a tributary of Moose River. It is known as Colonel Pass.

Between July 26th and August 6th nine stations were occupied with the camera, and two that had been occupied in 1921 were reoccupied. The party then moved down Colonel Creek, making a trail as it proceeded, and up Moose

*The Snaring river may possibly be a tributary of Snake Indian river.

River to a short distance beyond Steppe Creek Valley. Eight stations were occupied in the vicinity of Moose Pass from August 9th to August 17th.

On the 18th camp was moved across Moose Pass summit and down Calumet Creek to near its junction with Smoky River. Two stations were here occupied.

A move was now made down Smoky River valley to the junction of Chown Creek. A camp was pitched beside a small tarn close by the north margin of the latter stream, where the pony train crosses it. On August 24th and 25th three stations were occupied from this camp, and on the 26th camp was moved to the summit of Bess Pass.

The following day Mr. Wheeler, with a man and camp outfit, climbed the west shoulder of Mt. Bess and, crossing the Jackpine Pass, went in search of Mr. Lambart. On the afternoon of the second day they met him returning with his party. All hands returned to the camp at Bess Pass summit.

Meanwhile, between the 27th and 30th, Mr. Campbell had only been able to occupy one station, owing to the very dense bush-fire smoke that hung like a pall over the landscape. On the 31st two more stations were occupied at the summit of the pass with very poor results.

Nothing more could be done from this camp, so on September 1st the party moved back to the Smoky River and up the valley to near the mouth of Carcajou Creek where a camp was made. The next day was fine and a station was occupied at the junction of the two streams. The same day Mr. Campbell, who had camped some miles back, made the ascent of Lambart's "Wolverine" station and obtained some views. He also made connection with the photographic survey and occupied another station close by.

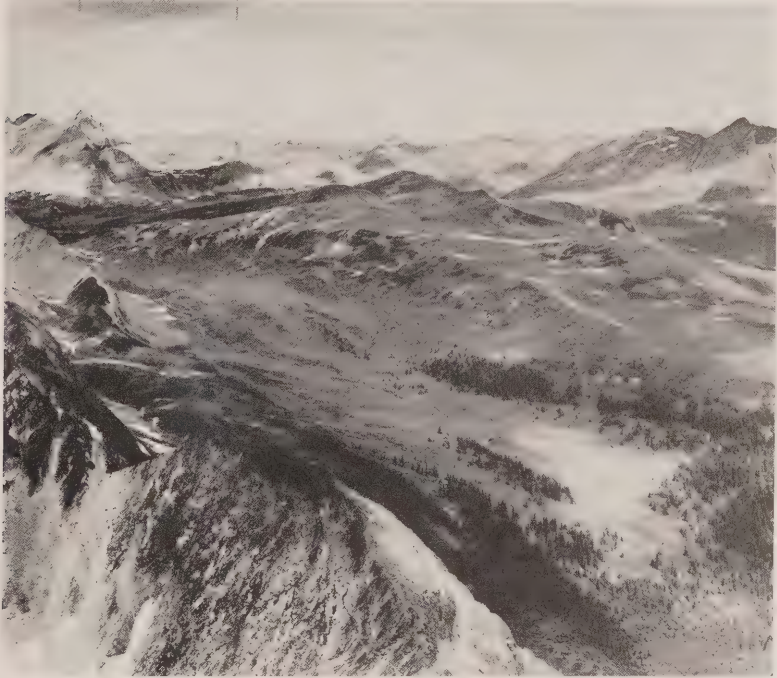
On September 4th the whole party moved up the valley of Carcajou Creek to a camp ground close by the glacial amphitheatre at its head. It snowed during the night and covered the mountains, and continued to snow at intervals for the next three days, with clouds low down over the valley. As climbing was now out of the question and photographing impossible until the new snow melted, a period of doubtful duration, the work was closed for the season and, on September 7th, the party packed up and travelled to the camp ground near the mouth of Calumet Creek. A return was made by way of Robson Pass, Fraser River valley, Yellowhead Pass and Miette River valley to Jasper, where the party arrived on September 13th, and on the 14th the members were paid off and disbanded. The field season closed by the usual check test of cameras for verticality of plates at Banff on September 18th.

Owing to the exceptionally dry, hot summer, bush fires were very numerous, and, for much of the time, the whole mountain region was wrapped in smoke, rendering photographic work extremely unsatisfactory. It was also necessary to curtail the length of the field season of the Topographical division in order to prolong that of Mr. Cautley's division, so that the area covered would have been below the average but for one circumstance: In 1911 the Alpine Club of Canada organized an expedition to the Mt. Robson region under Mr. Wheeler's direction. With the assistance of the Dominion and British

Columbia governments he then made a photo-topographical survey of Mt. Robson and its vicinity, an area since established as Mt. Robson Park. As a result of the survey a map of the area surveyed was published which, in large part, coincided with the area covered by the Boundary Survey. Thus, the camera stations occupied in 1911 were found serviceable to fill the deficiencies of the past season and to ensure fuller results than could otherwise have been obtained. All that was necessary was to connect the 1911 stations with those occupied in 1922 in order to use the earlier photographic work.

Salient Mtn.

Summit of Pass



MIETTE PASS—SOUTH PASSAGE

EXPLORATION IN 1921

At the close of the topographical work in 1921 Mr. Campbell, with a small party, was sent to explore the country along the watershed at the headwaters of Miette River, Grant Brook, and Moose River, with the object of ascertaining the number of passes crossing the Great Divide and the best route to obtain access to them in 1922. According to his report, he ascertained that between Yellowhead Pass and Moose Pass, the latter dividing waters tributary to Fraser River from those tributary to Peace River, there were four passes that permitted of travel with horses from one side of the watershed to the other. All these passes are shown on the Alpine Club of Canada's map of 1911, and in

addition two others beyond the scope of Campbell's exploration, viz., one at the head of Upright Creek, Upright Pass, and the other, a mountain pass, dividing the waters of Snake Indian River from those tributary to Moose River.

Campbell's passes Nos. 1 and 2 both lead from the headwaters of Miette River to the headwaters of Grant Brook and are close together. There is a third pass of the same series, and the three have been grouped under the name of Miette Pass, with South, Centre and North passages respectively.

Summit of Pass, C. passage
North passage



MIETTE PASS—CENTRE PASSAGE

Pass No. 3 divides the waters of Grant Brook from those of Snaring River and pass No. 4 divides the waters of Snake Indian River from Colonel Creek, a tributary of Moose River. This was as far as Campbell's exploration carried. He then occupied five camera stations and took a round of views at each. They have proved very useful to supplement the views obtained in 1922, owing to the fine, clear weather in which they were taken. It was only necessary to reoccupy the stations and connect them with the stations of 1923.

MIETTE PASS

The three crossings of the watershed which make up Miette Pass are separated by two low ridges, the more southerly ridge being the longer of the two. It is necessary to include all of the three crossings in the term Miette Pass, for the reason that they lie within a wide, open basin from which headwaters of the Miette and Snaring Rivers and of Grant Brook flow, and the high, rock escarpments that border the basin intersect the respective ends of the line of watershed across the three passages. For the most part the floor of the basin and the ridges followed by the watershed are open and grassy, or bare ground, with a scattering of stunted spruce and scrub, which becomes more thickly distributed along the several streams as they recede from the watershed.

Geodetic Sta. "Tub" Summit of Grant Pass Geodetic Sta. Salient S. Salient Mtn. Miette Pass
Mt. Machray



MIETTE PASS AND GRANT PASS

South Passage.—The trail to Yellowhead Pass climbs high up along the west side of the Miette Valley, to avoid a canyon near the river bed, and proceeds through a thick growth of forest until it comes to a branch valley, divided from that of the main stream by the longer of the two low ridges referred to above. At the head of this branch valley, which is practically at timber line and largely of open grassland, the first crossing of the watershed occurs and a traverse of the south passage leads to the wider part of the basin.

Centre Passage.—The centre passage is the main one although it is not followed by the trail. It leads from the main valley of the Miette, and at its summit and for several miles down the stream is open meadowland.

North Passage.—The north passage lies directly below the north escarpment of the basin. On the Alberta side the ground falls steeply to the divide between streams flowing north to Snaring River and south to Miette Lake, which lies

a mile or two down the valley. This stream is one of the heads, if not the principal head of Miette River. Both the pass, itself, and the valley of the stream flowing to the lake are almost entirely open, bare ground or meadowland.

GRANT PASS

Along the western side of the basin lies the valley of Grant Brook. The stream heads in a narrow gap, and the divide between it and a stream tributary



SUMMIT OF GRANT PASS

to Snaring River is crossed by the continental watershed. To this crossing has been given the name of Grant Pass. The valley is a narrow one, forested at its lower levels and rising just above timber-line at the summit of the pass. The trail, one little used except by the survey party, leads along the eastern slopes and presents few difficulties. The valley of Grant Pass lies between two outstanding mountain heights, Mt. Machray on the west side and, on the east, the isolated mass of Salient Mtn. Prominent among the several peaks of

the mass last named is that on which the triangulation station, entitled "Mons," now "Salient S.," is set at the extremity of its southern ridge.

The basin in which this series of crossings of the watershed lies is a delightful park-like area, displaying wide tracts of open grasslands, interspersed with groves and scattering bunches of picturesque spruce trees, which gradually merge into dense bodies of forest growth as the open highlands slope downwards to the valley bottoms, through which wind the several larger streams. All through the open highlands little watercourses with crystal flows wander in many directions.

The various rock escarpments that encircle the basin are accentuated at intervals by outstanding heights. A number of them have been occupied as camera or triangulation stations. On the west side is Razorback, and across its northern shoulder may be seen the mass of Mt. Mowat rising in the distance. Farther north, along the same escarpment rises Mt. McNaughton; and still farther, at the north extremity, Mt. Machray. On the north border of the basin is the mass of Salient Mtn. and the elevation on which the station named "Kemel" now Mt. McCord is set. Then, along the western escarpment, beyond the valley of Miette River is "Swank" station, now Mt. Beaupre, also occupied by the Boundary Survey. Next comes "Biff" Station, now Mt. Moren, and a number of other unnamed heights, terminating in the outstanding tower of Mt. Bridgland. The southern side is the opening of the Miette Valley and shows, in the distance, the mountains across the Fraser Valley.

The following camera stations were occupied around the margin of the basin and at points within it, viz.: In 1921, Miette Pass N., 7370 feet; Miette Pass S., 7575 feet; Grant Pass N., 6705 feet. In 1922, Trinity, 8327 feet; Razorback, 8548 feet; Centre, 7748 feet; Biff (Lambart), Mt. Moren, 8405 feet; Swank, Mt. Beaupre, 9115 feet; Mons, Salients, 8924 feet; Grant Ridge, McNaughton, 8258 feet; and Grant Pass, 8001 feet.

COLONEL PASS

The fourth crossing of the watershed located by Campbell's exploration was at the head of Colonel Creek. Westward, Colonel Creek flows to Moose River. On the other side a south branch of Snake Indian River, possibly Snaring River, after flowing north for some two miles from the Summit of Grant Pass, turns eastward in a valley at the head of which is Colonel Pass summit. Grant Pass valley is an extension of it.

The pass derives its name from the outstanding peak that rises immediately to the northwest of the summit, named "The Colonel." The Peak, the Pass and the Creek were so named by Mr. Wheeler in his 1911 exploration survey, after Colonel A. Laussedat, who was the originator of the science of phototopography, so extensively used for survey purposes in the mountain regions of Canada.

There is much open grassland at the head of this branch of Snake Indian River (possibly Snaring River) and the vicinity on the Alberta side is

parklike with bunches and scattering clumps of spruce trees. Two charming little tarns lie directly below the crossing of the summit, creating a delightful camp ground. Within two miles the valley narrows and is well forested at the bottom and for some distance up the sides.

The crossing of the watershed is an easy matter from the Alberta side, only entailing an ascent of some two hundred feet. On the British Columbia side the descent to the deep, heavily forested valley of Colonel Creek is more difficult and the going is bad on the steep hill slopes. Colonel Creek heads in a plateau-like basin directly east of "The Colonel." It is of considerable area

Moose River Valley
Mt. Robson

Colonel Ck. Valley

Summit of Colonel Pass
The Colonel



SUMMIT OF COLONEL PASS

and several camera stations were occupied around its rim. The creek has a course of some six miles to its junction with Moose River. Directly north of it "The Colonel" rises sharply in an isolated position and, although only 9140 feet in altitude, stands out as a prominent land-mark.

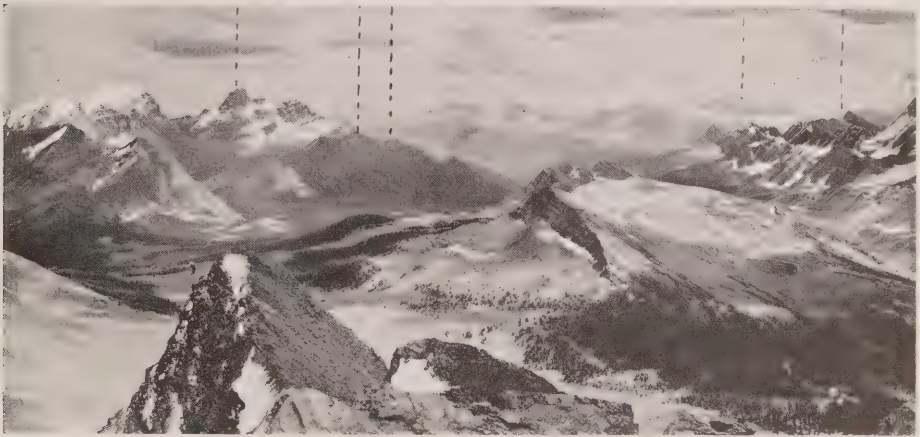
In all, eleven camera stations were occupied to map this section of the survey, as follows: In 1921, by Mr. Campbell, Colonel Pass N., 6620 feet; and Colonel Pass S., 6571 feet. In 1922, McCord N., 7656 feet; Colonel Pass E.,

8172 feet; Grant Pass, 7380 feet; Grant Pass W., 8969 feet; Plateau (Lambart), 8547 feet; Plateau N., 8500 feet; Plateau E., 8644 feet; Greys, 8349 feet; and Ginger, 8832 feet.

MOOSE PASS

Moose Pass is the next of importance. It is the one crossed by the pony trail leading to Smoky River by way of its tributary Calumet Creek. Between Colonel Pass and Moose Pass are two other passes. One at the head of the southern branch of Upright Creek is possible for horses. It lies four miles from Colonel Pass, a little east of north, and drains on the Alberta side by a tributary of Snaring River. The other is at the head of Campion Creek and cannot be used for pack animals. The stream flowing eastward from it is a tributary of

Mt. Bridgland Summit of Centre Passage
Miette River Valley Summit of S. Passage
Mt. Geikie



MIETTE RIVER VALLEY—LOOKING SOUTHEAST

Snake Indian River. The pass summit is situated some eight and a half miles northwest of Upright Pass. Four and a half miles a little north of west lies the summit of Moose pass.

Moose River heads at Moose Pass and its small volume is soon swelled by the flows of Campion creek, Upright creek and Colonel Creek from the east, and of Steppe Creek and Resplendent Creek from the west, all from extensive glacial sources. It is likely that of the last two Resplendent Creek has the greater volume as it has its sources in good sized glaciers on the east face of Resplendent Mt., and in the wide area of the Reef Icefield. Moose River joins the Fraser River some sixteen miles westerly from Yellowhead Pass summit and about two and a half miles southeast of Moose Lake, a fine sheet of water seven miles long, in the centre of the Fraser Valley. The general trend of the Moose River valley is a little west of north. Some seven miles from the junction with the Fraser, Resplendent Creek comes in. After a few miles—five or six—its valley

opens to wide gravel flats and the stream is fed by a number of tributaries. The two principal streams drain from the glaciers of Resplendent Mt. and the Reef Icefield, the latter an extensive ice and snow area, of which the centre is traversed by the watershed in a general north and south direction on a somewhat erratic course.

Six miles from the junction of the two main streams, Moose River is joined by Colonel Creek, and four miles farther on by Upright Creek, which derives its supply in part from glaciers on the south face of Upright Mt. Another four miles up, Steppe Creek comes in from the west, draining from Steppe Glacier, an adjunct of the Reef Icefield. A mile and a half beyond this tribu-



THE COLONEL

tary, the stream divides for the last time, the western flow coming from Moose Pass summit, and the northern flow, previously referred to as Campion Creek, from glaciers on the watershed. The Moose River Valley is broad and deep, and the stream winds through it on a very sinuous course. Owing to the many tributary streams from glacial sources it fluctuates greatly in the volume of flow, but at all times it is a swift and somewhat risky torrent to ford.

The altitude of Moose Pass summit, according to the computation of the survey, is 6570 feet. The summit of the pass is of a rather peculiar character. It lies in a narrow valley above the local timber-line. A fall of rock has filled up the valley bottom. The crest of the fall is the highest part of the floor of the pass, and yet, northward beyond it, at a lower elevation, is a small tarn in a deep basin, which sends its flow southward through the rockfall.

The defile at the summit very shortly opens to the broad, alpland valley of Calumet Creek, close to its head. There are wide stretches of alpine meadows here adorned by a most luxuriant growth of mountain flowers, of which the blue lupin is the most striking owing to the masses of bloom, which are so thickly grown that they give the ground a bright blue colouring. Calumet Pk. 9766

feet in altitude, dominates the head of the valley and is the centre of a series of glaciers flowing to all parts of the compass. Calumet creek has a course, a little south of west, of some six miles to its junction with the Smoky River. The lower reaches of the valley are heavily forested, and the trail passes through a considerable area of brûlé. Some five miles up the Smoky Valley from the junction of Calumet Creek is the summit of Robson Pass.

Summit of Pass



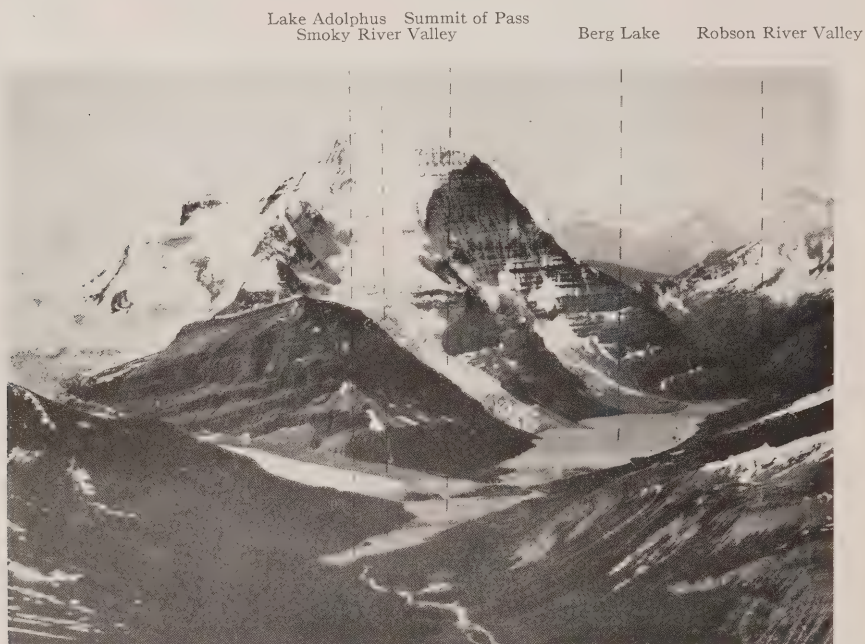
SUMMIT OF MOOSE PASS

The following camera stations, eleven in number, were occupied to map the Moose Pass and Calumet Creek area, viz.: Treadmill Ridge, 8580 feet; Treadmill N., 8087 feet; Pisgah, 8230 feet; Treadmill E., 8705 feet; Stonyside, 7160 feet; Stony Bend, 7216 feet; Moose Pass E., 7383 feet; Upright N., 8911 feet; Moose River Hd., 9047 feet; Calumet W., 9282 feet; and Calumet Ridge, 8765 feet.

ROBSON PASS

The name, Mt. Robson, is known far and wide as the highest mountain of the main range of the Canadian Rockies. Before the exploratory survey by the

Alpine Club of Canada in 1911, its altitude had been computed by J. McEvoy of the Geological Survey of Canada at 13,700 feet. The results of the survey then made, based upon the computed altitude of benchmarks along the Grand Trunk Pacific Railway, reduced this altitude to 13,068 feet. The results of the more accurate surveys of 1922 have reduced the altitude still lower to 12,972 feet. The latest results are based upon precise levels taken along the Canadian National Railways by the Geodetic Survey of Canada, which have been established at Yellowhead Pass, and carried as trigonometrical levels from there to Mount Robson by the Boundary Survey.



NORTHEAST FACE OF MT. ROBSON, BERG LAKE AND LAKE ADOLPHUS
Aerial photograph by H. F. Lambart

The wide-spread fame of this great mountain, due not so much to its altitude as to the spectacular scenic beauties of its ice and snow surroundings, and the difficulty of making an ascent on account of the very uncertain climatic conditions, yearly attracts many visitors. The most direct route to it is from Mount Robson Station on the Canadian National railways by way of the valley of Robson River (formerly known as the Grand Fork of the Fraser). The route is magnificently picturesque. It passes by the shore of Kinney Lake, a deep set tarn of wondrous blue, at the base of Whitehorn Mt. and then up the Valley of a Thousand Falls to Berg Lake, below the northwest face of the mountain.

The name, Valley of a Thousand Falls, was bestowed by the Rev. G. B. Kinney, who first visited the region with Coleman and participated in his attempts

to climb Mt. Robson. Later, in 1910, Kinney accompanied by Donald Phillips, a mountain guide, succeeded in making the crest of the mountain after several attempts entailing great hardship and wonderful perseverance and endurance. Kinney was with Wheeler during the exploratory surveys of 1911. Of the Valley of a Thousand Falls, Wheeler writes in the *Alpine Journal* of November, 1912, under the heading "The Mountains of the Yellowhead Pass": "The Grand Fork River, having left Berg Lake, and cut through the boulder wash from the glaciers referred to, flows quietly in many channels over a shingle flat for a mile below the lake. It then enters a narrow rock canyon, and soon becomes a cascade, careering wildly down its bed and showing a great swirl of white water. In half a mile there are five leaps of from 10 to 50 feet, and the stream



THE EMPEROR FALLS
Head of Valley of a Thousand Falls

drops 200 feet. Then comes a line of cliffs extending part way across the valley. Over this the river makes a grand and spectacular leap to a rock floor below, where it turns sharply to the left and pours madly through an extremely narrow box-canyon which it has carved in the bed rock. The fall is magnificent and the writer knows of no other of quite the same type. The total drop is 145 feet by aneroid barometer measurement. At a distance of 60 feet from the crest, the full volume of the water strikes a ledge and bounds outwards for 30 feet creating a splendid rocket which gives the idea of a giant leap. There is such

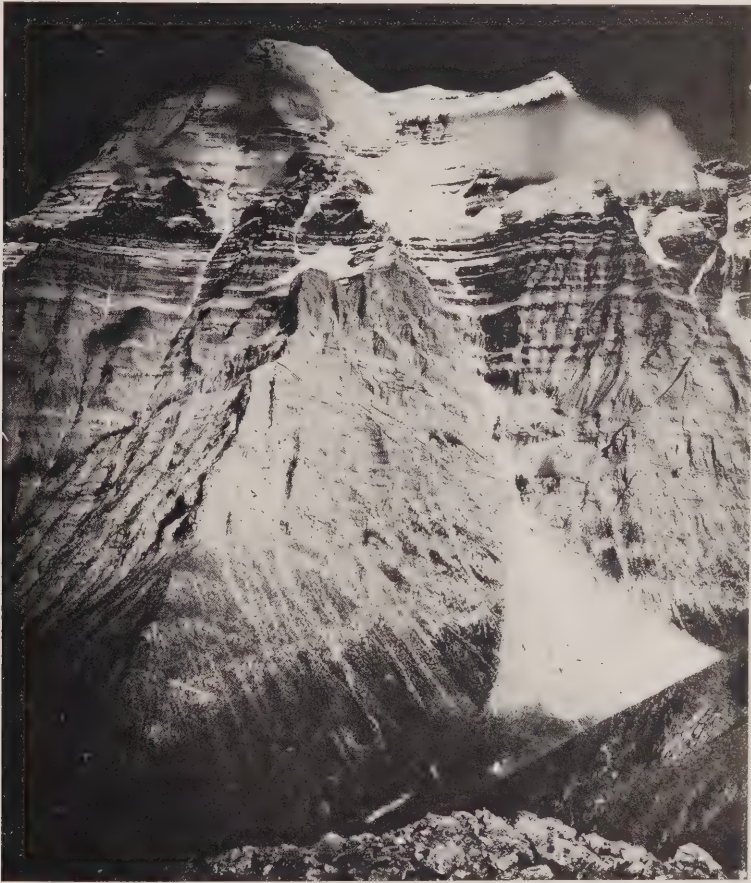
a feeling of majesty and power inspired by the spectacle that it was christened 'The Emperor Falls' and the rocket 'The Emperor's Leap'. The river now races through a narrow rip in the rock, 6 to 10 feet wide, churning and swirling and leaping in the wildest manner. This is a distinctly new channel as geological time counts. Close alongside is a deep gorge where the river formerly flowed. There was then no big fall, for the gorge opens from the shingle flats, and descends by a steady grade. It is deep and trees hundreds of years old are growing at the bottom. The present bed and the old one come together about a mile below the falls, where there is another line of cliffs across the valley. Here is a second big fall of 150 feet. It suggests the name of the 'Fall of the Pool'. Two-thirds of the way down is a tiny pool in the rock into which the water leaps; the lower part is more broken. The river then proceeds on its way still in a deep rock canyon, to the last line of cliffs, down which it leaps in a great curve of white foam. 'The White Falls' would be an appropriate name." Those referred to are the major falls along the course of Robson River, as it is now called. There are many others, and all around on a fine, hot day numbers of them may be seen leaping down the cliffs from great heights, fed by the glaciers at higher levels. Berg Lake fills the valley bottom on the west side of the watershed, and on the east side is Lake Adolphus. Both lakes are gems of scintillating blue, the former often studded with fantastically shaped little icebergs, originating from masses of ice that fall, with reports like thunder, from Berg Glacier into the lake. Berg Glacier is the most spectacular feature of the northern face of the mountain. It has its source at the very crest, 7500 feet above the lake. Between the two lakes lies a mile of shingle flat, in places timbered with open spruce. On this flat, nearer to Lake Adolphus is the continental watershed.

The location of the watershed will be something of a problem. Robson Glacier at its snout is divided into two tongues and has, in past years, sent a flow to both Lake Adolphus and to Berg Lake, on the Alberta and British Columbia sides of the watershed respectively. Of late years by far the larger part of the flow has gone from both tongues to Berg Lake, but some small part has gone to Lake Adolphus. The recession of the ice has been so great that it is claimed no flow went to Lake Adolphus last year and that it is no longer possible unless the ice should again advance. It is thought that under the circumstances the course of the watershed will lie up the Robson Glacier, but its actual location can only be decided by a careful survey and study of the conditions.

The Robson Glacier and the ice-filled basin from which it flows extend back from the pass summit for some five miles along the eastern flank of the mountain and are known as the Robson Cirque. The wonderful creations of ice and snow there accumulated justly constitute it one of the wonders of the Canadian Rockies, and its fame has gone far and wide. The massif with its glaciers and glacial lakes covers an area of over thirty square miles and measures three miles through at the base where it rises one and a half miles into the air above

the summit of the pass. The Robson Pass valley is the direct route from the Fraser River to the headwaters of the Smoky River, a tributary of Peace River, although at the present time it is only open to packtrain travel.

The origin of the name is still a matter of doubt. Mr. H. J. Moberly, a well-known Factor of the Hudson's Bay Company, in reply to a letter from Mr. Wheeler, states that he had always heard that it was so called after a man



SOUTH FACE OF MT. ROBSON

named Robson, who was a foreman in charge of a hunting camp in the vicinity of the mountain, which was a rallying point where the other parties came together for their return east. Be this as it may, it seems likely that if it was not named after the Robson referred to it was named after some other officer of the company, of whom there appear to have been more than one bearing that name.

BESS PASS

Chown Creek joins the Smoky River some twelve to fourteen miles downstream from the junction of Calumet Creek with the latter. The trail crosses Chown Creek about half a mile from its mouth. The stream has its source in a large glacier flowing from an icefield which is snow-covered to the very sum-

Summit of Pass

Mt. Bess Bed of Chown Ck.



SUMMIT OF BESS PASS

mit of Mt. Chown. The bed of the torrent consists of a wide gravel and boulder flat, for all of its course, some five miles in length.

About one and a half miles west of the head of the stream up the valley of a small tributary is a crossing of the watershed, which has been named Bess Pass, with reference to Mt. Bess, the great mountain mass, 10,550 feet in altitude, which rises directly above it to the north.

August 26th, 1911, the mountain was climbed by Dr. Norman Collie and A. L. Mumm, led by the Swiss guide, Moritz Inderbinen. Mt. Bess was, according to Dr. Collie's report in the *Alpine Journal* issue of February 1912, so named by John Yates the mountain guide who had charge of the transport of the party.

In appearance it is a huge truncated mass of which the top is of a plateau-like formation which, Mr. Mumm says, must be fully a quarter of a mile across.

Some three or four miles a little west of north is Mt. Chown, rising, as seen from the Bess Pass side, a pure white mass, clad from summit to base in a shroud of snow. It is 10,930 feet in altitude. The snow face of the mountain merges with the névé below, which sends forth several fine glaciers showing spectacular icefalls. On the north side lies another broad névé which, in its turn, sends down more glaciers. The area is a centre of ice and snow, and is practically

Mt. Chown Summit of Mt. Bess



MT. CHOWN—10,930 FEET ALTITUDE

Aerial photograph by H. F. Lambart

the northern extremity of the high Robson group, specifically known as the Rainbow Mountains. The name is, presumably, derived from the diversity of colouring of the rock masses in various parts of the group. The mountain is named for the Rev. S. D. Chown, D.D., LL.D., General Superintendent of the Methodist Church in Canada.

The altitude of Bess Pass summit is about 5330 feet. The approach on the Alberta side by way of Chown Creek and its tributary is an easy gradient, but on the British Columbia side it soon falls very steeply by the valley of a tributary of Holmes River to the bed of that stream which, after a course of some twenty miles, joins the Fraser River near McBride on the Canadian National railways. The valley of Chown Creek is deep and hemmed in by bold mountain forms, holding icefields and glaciers in their hollows. They culminate at the summit of Bess Pass.

The pony trail does not descend to the valley of Holmes River. On the contrary, it climbs the steep lower slopes of Mt. Bess and, following the western base of the mountain high up, crosses Jackpine Pass summit, situated some three miles to the northwest. It then drops very steeply to the Jackpine River valley which it follows a little west of north to where the course of the stream turns northeast. The valley is broad and well forested along its slopes. The upper reaches show wide gravel bottoms merging into swampy meadowlands, much frequented by beaver.

CARCAJOU PASS

Nearly midway between Bess Pass and Robson Pass is a pass of the watershed which is locally known as Wolverine Pass. There is another Wolverine Pass in a more southerly part of the Canadian Rockies, and this name has been confirmed by the Geographic Board, so the pass under discussion is here referred

Mt. Bess

Mt. Chown
Chown Glacier

MT. BESS AND MT. CHOWN

to as Carcajou Pass, a synonym for Wolverine. The pass is of a peculiar formation and of a type not before met with. Just about halfway between the confluence of Calumet Creek and of Chown Creek with Smoky River, Carcajou Creek flows in from the south. The valley lies to the west of the Smoky, and is wide and thickly timbered for the first mile and a half of its course. The bottom then opens out in a broad morass, where lie many ponds of water, several of considerable extent. Through this morass the stream divides into numerous channels, of which by far the greater number and volume flow northwesterly to form the headwaters of Holmes River, the lesser number flowing northerly to unite later in the bed of Carcajou Creek. Somewhere in this indefinite morass

is the watershed but, as the whole is more or less under water, it is difficult to say just where it lies. The altitude of the pass summit is, at the present stage of the survey, not definitely known but it is well below timber-line.

Above the morass the valley bottom consists of a shingle flat thickly grown with willows and small, scattered bunches of spruce. Through this a glacial torrent, split into many channels, flows swiftly. The main channel is distinctly the headwaters of Holmes River. It flows through the morass on the western side in well-defined waterways which, later on, combine in a single stream of considerable volume. The entire length of the valley is between three and four miles. It heads in a magnificent glacial cirque where several spectacular icefalls converge in one grand cascade. Broad stretches of icefield extend westerly to Mt. Longstaff, 10,440 feet in altitude, and south to Whitehorn Mt., 11,130 feet, and Mt. Phillips, 10,660 feet; to the east a glacier descends from Gendarme Mt., 9586 feet. It is an exceptionally fine cirque, wonderfully set with ice and snow.



MT. CHOWN AND CHOWN GLACIER

The watershed lies along the ridge separating the Carcajou Pass basin from the Valley of a Thousand Falls, and some large-sized glaciers line the northern slopes of the Robson River valley. The whole area is magnificent, and is an outstanding scenic centre of the Canadian Rockies.

Nine camera stations were occupied to provide data for mapping the Bess Pass and Carcajou Pass section of the survey, viz.: Chown Creek N. No. 1, 7592 feet; Chown Creek S. No. 2, 7917 feet; Chown E., 8370 feet; Bess S.E., 8219 feet; Bess S.W., 8460 feet; Mt. Jessie, 8702 feet; Carcajou Creek N., 7278 feet; Wolverine Mt., (Lambart), 9110 feet; Wolverine Shoulder, 8405 feet.

GENERAL REMARKS

Watershed.—The survey of Yellowhead Pass, made in 1917, located the watershed northward as far as Mt. O'Beirne. From the summit of that mountain it lies in a northerly direction for one and three-quarters miles between the basin of Rink Brook on the east and the basin of a tributary of Grant Brook on the west; then, following an erratic course northwesterly, at one and three-eighths

Mt. Phillips Carcajou Ck. Wide Morass Valley of Holmes R.



VALLEY OF CARCAJOU CREEK AND MT. PHILLIPS

miles it passes over Trinity camera station, and continues on the same erratic course between Grant Brook and a tributary of Miette River, for two and seven-eighths miles to the summit of Razorback camera station.

At Razorback the course turns northeasterly, a distance of one and a half miles, and the watershed crosses the south passage of Miette Pass. It then assumes its northwesterly direction and, bending eastward around a small lake with an outlet to Grant Brook, crosses the centre and north passages of Miette

Pass to near Mt. McCord, (Kemel station of the Geodetic Survey) covering a distance of four and one-half miles, and arriving at the headwaters of Snaring River.

From Mt. McCord the course is most erratic and is generally westerly to the summit of Grant Pass, distant some five and one-quarter miles by the line of watershed, although only three and one-half miles in direct distance. En route it passes over Mons station of the Geodetic Survey, Salient S. camera station and over the summit of Salient Mt.



LYNX MOUNTAIN—NORTH FACE

Beyond the summit of Grant Pass, the watershed has a southerly course when, for two miles, it circles around a glacier on the eastern slope of Mt. Mach-ray, but at Grant Pass W. camera station it swings northeasterly for a distance of five and one-half miles to Ginger camera station. One and three-quarters miles from Grant Pass W. it crosses the summit of Colonel Pass.

There are here, at short distances apart, five separate crossings of the Great Divide, viz.: The south, centre and north passages of Miette Pass; Grant Pass; and Colonel Pass. In direct distance the centre passage of Miette Pass lies one and seven-eighths miles a little east of north of the south passage; the north passage one and one-eighth miles north of the centre passage; Grant Pass four and a half miles northwest of the centre passage of Miette Pass; and Colonel Pass one and seven-eighths miles north-northwest of Grant Pass.

From Ginger camera station the watershed extends northwesterly on a very irregular course for fourteen and one-quarter miles, when it turns nearly due west and crosses Moose Pass at a distance of three and one-half miles. For all of the northwesterly course the watershed lies between the waters of Moose River on the British Columbia side and those of Snaring and Snake Indian

Lynx Mt.

Mt. Resplendent

E. Face of Mt. Robson



THE COLEMAN GLACIER AND EAST FACE OF MT. ROBSON

Rivers on the Alberta side. On the west course the headwaters of Moose River are on the one side, and of Calumet Creek a tributary of Smoky River, on the other. Upright Crossing is two and three-quarters miles northeast of Ginger camera station. The next is a crossing at the head of Campion creek twelve and a half miles from Ginger camera station; and then Moose Pass crossing.

The last crossing is the most important because it is the one followed by the trail to the Smoky River valley. At this point the watershed turns on a general south course, a very irregular one, for some nine and a half miles, following the eastern border of the ice area above Moose Pass valley and crossing, between Coleman and Steppe Glaciers, nearly through the centre of the Reef Icefield to Reef Glacier camera station.

From Reef Glacier station to the summit of Lynx Mt. the watershed lies nearly due west for seven-eighths of a mile, and then travels in a curve south and west along the ridge separating the head of Resplendent Valley from the

Robson Cirque. The length of the course is practically two and a quarter miles, from which point the watershed drops on a course north-northwest to the crest of the outstanding rock known as the Extinguisher, and from there down the ice of the Robson Glacier to the summit of Robson Pass and beyond it, on the same course, to the summit of Mumm Pk., a total distance of six and one-half miles.

The position of the watershed at Robson Pass cannot be properly defined until an accurate survey is made. At the present time the ice-tongue of the Robson Glacier has so greatly receded that all the flow during the summer of last year appears to have gone to Berg Lake in British Columbia. Were this to remain a permanent condition, it is likely that the watershed north of Lynx Mt. would lie along the Tatei Ridge, from one to two miles eastward of its present position but crossing the summit of the pass at nearly the same place. However, we have still as a factor, the possibility of a future advance of the ice-tongue, which might readily upset the Tatei Ridge location, seeing that within the knowledge of explorers yet living the major volume of the outflow from Robson Glacier has gone to Lake Adolphus on the Alberta side of the pass.

From the summit of Mumm Pk. the watershed follows the serrated ridge between the Valley of a Thousand Falls on the south side, and the Mural Glacier and highly glaciated amphitheatre at the head of Holmes River on the north. The distance along the watershed ridge from Mumm Pk. westerly to Mt. Phillips is approximately five and seven-eighths miles. Beyond Mt. Phillips the watershed is not yet located with sufficient accuracy to be shown upon a map. This part is a magnificent area of ice and snow, and presents some wonderfully spectacular scenic features.

Trails.—There are no good trails within the area surveyed during 1922, and the majority resemble tracks more than trails. The best is that up the valley of Miette River leading over Yellowhead Pass and down the Fraser Valley. The old railway construction road and the roadbed of the discarded portions of the Grand Trunk Pacific and Canadian Northern railways, of which the more adaptable parts have been combined to serve the Canadian National railways, provide a better class of travel. All others lead through forest, or across open alplands, up and down steep hill-sides or along swampy margins of the various streams, and are much littered by windfall and the outcrop of ancient rockfalls that are but partially covered by humus.

In addition to the route for ponies in the Miette and Fraser Valleys, there are two others leading to the Smoky River, viz.: that up Moose River Valley to Moose Pass and the one up Robson River valley to Robson Pass. The Moose River route is very swampy and stony for the most part, and the Robson River one is very hilly and rough. A third route was found partially opened by the Jasper Park forest rangers. The topographical party travelled to the end of this trail, as far as cut out, and then by way of Miette and Grant Passes to the head of Snaring River. Crossing over Colonel Pass summit a path was cut out to the bed of Colonel Creek and its margin followed to a junction with the trail

up Moose River valley. It was pretty poor going for a first trip. The chief advantage of this route is the abundance of horsefeed, of which there is practically none to be had on the Robson River route until Robson Pass summit is crossed.

From Moose Pass summit a track leads down Calumet Creek Valley to Smoky River, where it joins the trail over Robson Pass. The combined trails then lead down the Smoky Valley to the crossing of Chown Creek and onward. At Chown Creek crossing the path to the northern interior lies up the wide gravel flats forming the bed of the stream to near its source in Chown Glacier, where it follows the valley of a tributary stream to the summit of Bess Pass. Descending on the British Columbia side, the path soon climbs up a very steep hillside to a high shoulder of Mt. Bess, and over the same to Jackpine Pass and Valley. There is also a faint trail up Carcajou Creek Valley to the morass, where it vanishes.

The trails are kept in evidence by odd parties of tourists and surveyors, and by hunting parties in the autumn months. The only work done upon them is the cutting out of fallen timber and possibly the placing of a little corduroy across the worst of the swampy places. Otherwise, they go on the same from year to year, showing more or less distinctly according to the amount of travel over them. They always follow the line of least resistance and are therefore somewhat sinuous, seldom going for more than a short distance in any one direction. They are only serviceable for travel by packtrain methods.

Rivers and Streams.—The area covered by the 1923 survey embraces several good sized streams. A tributary of the Fraser flows from the summit of Yellowhead Pass which, after a course of some two and one-half miles, flows into Yellowhead Lake. The lake is three and one-half miles long. Two-thirds of the way down are narrows, across which a bridge leads to the railway village of Lucerne, until recently a divisional point of the Canadian National railways. Within three-quarters of a mile, a second narrows occurs, from which it is very little more than a quarter of a mile to the end of the lake. After a flow of about one mile the outlet from the lake joins the Fraser River. The upper reaches of the Fraser flow from the summit of Fraser Pass and together with its tributaries, have been dealt with in Chapter V, Part II (1921).

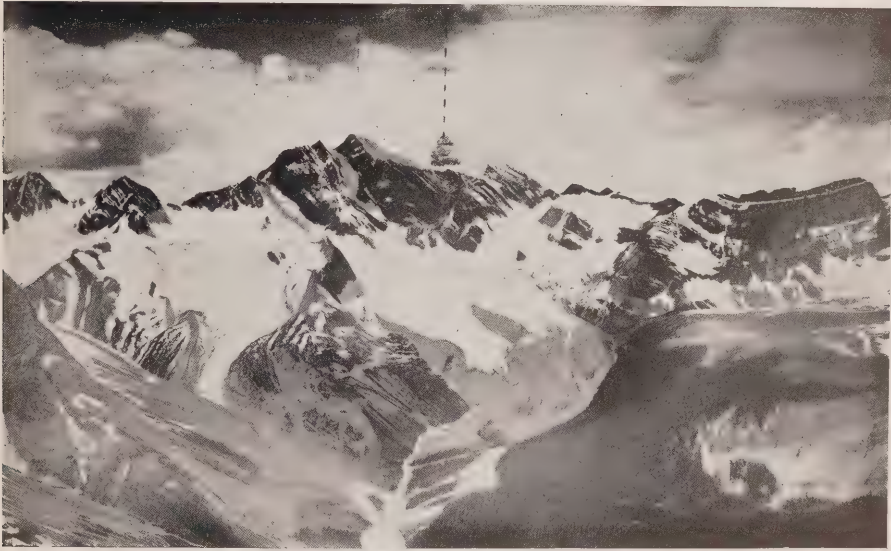
Miette River flows very close to the summit of Yellowhead Pass, on the east side, and then, after a somewhat sinuous course of twenty odd miles, joins the Athabaska a mile from Jasper Station on the Canadian National railways. The stream heads in the vicinity of a series of passes, collectively known as Miette Pass, which leads across the Great Divide to Grant Brook; also in a pass leading to Snaring River, likewise an Alberta stream. It is soon joined by strong-flowing tributaries. Here there is a delightful alpine parkland which extends to the head of Grant Brook on the British Columbia side of the divide.

Grant Brook, heading at the summit of Grant Pass, is a tributary of Fraser River which it joins some fourteen miles from Yellowhead Pass summit. Two and a half miles farther on the Moose River flows in. It has a course of approxi-

mately thirty miles to the summit of Moose Pass. About seven miles from its junction with the Fraser the main stream is joined by a tributary of nearly equal volume, flowing from the glaciers of Resplendent Mt. and augmented by a strong flow from the reef Glaciers, which drain the Reef Icefield. Locally this tributary is known as the "West Branch" but it has recently been given the name of Resplendent Creek by the Geographic Board of Canada.

The northern drainage from Moose Pass flows to Calumet Creek, which stream has a run of some six miles to the Smoky River. The Smoky River heads from Lake Adolphus, on the northeast side of Robson Pass, but its chief source is from Coleman Glacier, which drains from the Reef Icefield, and from

Resplendent Mtn.
Mt. Robson



GLACIERS AT THE HEAD OF RESPLENDENT VALLEY

other glaciers adjacent to it. There are open grasslands at the head of the stream, which furnish a good grazing ground. Below the junction of Calumet Creek the bed opens to broad gravel flats traversed by a net-work of channels.

On the British Columbia side of Robson Pass, Berg Lake is the source of Robson River, which joins the Fraser some thirty-five or forty miles from Yellowhead Pass summit. Robson River is known locally as the "Grand Fork of the Fraser." Owing to its very beautiful and spectacular scenic features (Lake Kinney, the Valley of a Thousand Falls, Berg Lake, Berg Glacier, etc.) it is of much repute.

Between seven and eight miles from the junction of Calumet Creek with Smoky River, Carcajou Creek joins the latter. It flows from the previously described morass at the summit of Carcajou Pass. From the same morass

also originates Holmes River, which joins the Fraser some five miles above McBride, a divisional point of the Canadian National Railway system.

Six miles farther down, Chown Creek, heading from its sources at Chown Glacier and Bess Pass summit, comes into the Smoky. It has a short course of some six miles, and from its source in Chown Glacier to the junction, the floor of the valley in which it flows is a wide gravel flat.

There are many other smaller streams tributary to those referred to, which are the principal waterways of the area encompassed by the survey. Miette River and Grant Brook have a clear water flow, but all the other streams fed from a glacial source are turbid during the summer months due to the large quantities of rock silt carried in suspension by their torrents.

Timber.—The forest growth is of the usual type. Very little timber was noticed of sufficient dimensions to give it commercial value, and in no case were stands of any great size met with on the Alberta side of the watershed. Pine, of the lodgepole variety, and spruce predominate and, at high altitudes, the balsam. No larch was seen.

On the British Columbia side the valleys, owing to a greater precipitation, are heavily forested in the lower altitudes. Douglas fir and cedar are seen, and dense undergrowth makes travel off the trail much more difficult. Scrub birch and alder, huckleberry and devil's club are met with. Large Douglas fir were noticed in the Fraser Valley, but not in large quantity. Some good-sized cedars of picturesque proportions are passed on the trail by the shore of Kinney Lake. These trees should be preserved as a part of the scenic surroundings. There is also cedar timber on the high slopes surrounding the basin of Kinney Lake, but its situation does not favour economical lumbering and all such growth in Mt. Robson Park should be rigidly preserved.

In the Miette River Valley the timber is of small size and there is much open area of parkland character. The same applies to the various heads of the Snaring and Snake Indian Rivers. In these delightful natural parks are seen, in clumps or singly, the extremely handsome and graceful spruce trees, found only at high altitudes where timber line is nearly reached. So exquisite is their shape and so regular their form that they look as though they had been most carefully cultivated and protected from the storms of the highland wilderness.

The Smoky River Valley is sparsely forested in its upper reaches. The same applies to Jackpine River Valley and to other streams on this side of the divide, where long stretches of swampy meadowlands and beaver meadows are seen. As soon, however, as the Great Divide is crossed the valleys tributary to the Fraser become narrow and heavily timbered.

Game and Fish.—As usual the Rocky Mountain goat was seen high up on the crags. Bear were in the woods and several kinds of small deer. In addition a number of moose were seen, particularly along the margins of the swampy meadowlands. Woodland caribou are found in the alpine tracts near to and above timber-line. No mountain sheep were seen but not far beyond

the summit of Bess Pass, on the high open ridges parallel to the Jackpine Valley, they are to be found, as also numerous caribou. Beaver houses and dams are to be seen in isolated swampy places and more plentifully in the wide meadows of the Jackpine Valley.

Fish may be caught in the Miette headwaters, and a number of trout were taken from Miette Lake. As fish are known to frequent Yellowhead Lake it is assumed they are in the Fraser and its tributaries, but the water is so turbid from silt during the summer months that they are not seen and none were caught.

MAPS

Sufficient information was obtained during the season to practically complete map sheets Nos. 30, 31 and 32, but further data was required before sheet No. 34 could be fully drawn. This was obtained during the following season.

The great prevalence of forest fires throughout the summer was most detrimental to photographic surveying, owing to the landscape being dimmed by smoke for protracted periods; but this drawback was, in large measure, made up for by the availability of data obtained during the 1911 surveys of the Alpine Club's expedition. A particularly good map sheet has been made of Mt. Robson and its vicinity—one that will be most useful in view of the prominence it is acquiring in the eyes of the tourist world.

CHAPTER II

TOPOGRAPHICAL SURVEYS EXECUTED IN 1923

The work of the Boundary Survey was conducted as in past years. Acting under instructions from the Surveyor General of Dominion Lands, Mr. Cautley's division continued the production of the 120th meridian north from monument 84-5, which was the most northerly point reached by his survey in 1919. A full report of his operations by Mr. Cautley will be found in Part III-B of this Report.

GEODETIC SURVEY TRIANGULATION

The Geodetic Survey of Canada again co-operated with the Boundary Survey and Mr. H. F. Lambart of the former survey continued the triangulation to connect the Dominion Lands Surveys at Yellowhead Pass with the 120th meridian at its intersection with the watershed. Three parties were placed in the field under Mr. Lambart's direction, namely; a reconnaissance party, of which he took personal charge, and two observing parties engaged in reading the angles between the various stations established by him during the previous season.

Mr. Lambart's party continued the reconnaissance from the stations "de Veber" and "Pauline" at the end of his 1922 season's work. He carried the triangulation to Jarvis Pass, where he located a base to control the northerly portion of the chain. Eleven observing stations were selected and cairns built at them for the use of the angle reading party of the next season. While at this work Mr. Lambart identified and took readings on the cairn built by Mr. Cautley at the end of his 1922 season on Mt. Torrens.

The Topographical Division tied in the camera stations of the phototopographical survey with the cairns built by Mr. Lambart and, with the completion of the triangulation, the definite location of the watershed and of the topographical features adjacent to it became known, and accurate maps could be published.

DESCRIPTION OF OPERATIONS

The Topographical Division was organized at Jasper and made the necessary tests of survey cameras, etc., at that place. This work and the collection and preparation of outfit and supplies occupied from June 7th to 9th.

The survey had been discontinued the previous season at Bess Pass, distant six days by pack-train from Jasper, and as the party would be constantly getting farther away, it was necessary to get supplies forward to the field of operations as soon as possible.

On June 10 the assistant, Mr. A. J. Campbell, D.L.S., moved out with eighteen head of pack-horses loaded with supplies to establish a cache at Colonel

Pass, situated about halfway. The streams were in heavy flood and one horse was drowned and a load of supplies lost when crossing Meadow Creek. In addition to this piece of bad luck, eight head of horses wandered away looking for food, of which there was very little so early in the season. The three days lost from this cause compelled Mr. Campbell to cache his loads when two days out, and he returned to Jasper on the 15th. Mr. Wheeler arrived with the full party the same day and another pack-train was got ready.

A start was made June 18th, but again delay was caused by missing horses wandering in search of food. While they were being looked for the party moved to Yellowhead Pass and cleared out the trail up the big hill to the north; supplies, which had to be relayed, were also sent forward.

Colonel Pass was reached June 25th and the party moved forward as rapidly as possible. Relaying supplies, hunting lost horses and clearing out trail took much time and it was July 6th before the party arrived and went into camp at the mouth of Carcajou Creek. En route for Bess Pass it was necessary to make a quick trip to Carcajou Pass to obtain information that could not be had the previous season on account of storm conditions while working there. Between July 7th and 12th five camera stations were occupied in the vicinity of the pass summit.

Bess Pass was reached on the 16th and two stations occupied on the 17th. The party now moved over Jackpine Pass, occupying camera stations en route. Between July 21st and 31st fourteen stations were occupied on the heights bordering the Jackpine River valley and westward towards the Holmes River valley, in close proximity to the main watershed which lies between the two valleys. Of the stations occupied three had been established by Mr. Lambart the previous season in connection with his triangulation, viz., "Whistler," "Holmes," and "Resthaven."

Hindered by rain and snow, only four stations could be occupied between August 1st and 10th. On August 11th a trail was cut up the valley of Meadowland Creek, and on the 14th camp was moved to Loren Lake Pass. From August 15th to 20th eight stations were occupied, and on the 21st the party moved over Jones Pass, an Alberta watershed, to Oasis camp. On August 23rd a move was made to Beaverdam Pass. Owing to low clouds and rain only five camera stations were occupied between August 24th and 31st, the geodetic station "Pauline" being one of the number.

From the camp at Beaverdam Pass a flying trip was made some six or seven miles southwest to Mt. Renshaw, which was occupied and provided a most useful camera station. The summit of Avalanche Pass was located and its altitude ascertained.

The party then moved down the valley of Pauline Creek, and, following a trail over the Big Shale Hill, camped in a valley on the north side below Talbot station of the geodetic survey, where it was delayed for four days by rain and snow. A move was then made to Morkill Pass and, on September 6th, camp was pitched on the bank of Muddywater River. Between the 6th and 8th four

stations were occupied of which "Talbot" and "de Veber" had been established by the Geodetic Survey. The party moved to Fetherstonhaugh Pass on September 10th and between that date and the 14th nine stations were occupied, of which "Sprague" was a geodetic station.

The survey had now been carried as far north as the season would permit so, on the 16th, the party started for Jasper, returning by the Jackpine and Bess Passes to Robson Pass, and thence to the Fraser River valley, up which the

Holmes River Carcajou Ck.
Summit



MORASS AT SUMMIT OF CARCAJOU PASS

route lies over Yellowhead Pass and by the Miette River valley to Jasper, where the pack-train arrived on September 28th.

En route, on September 27th, two stations were occupied on the west side of Moose River valley near its junction with the Fraser, to secure information missing from the survey of the previous season. The members of the party engaged in this work took the train to Jasper, where all arrived on the 28th and the party was paid off on the 29th.

It was an exceptionally good season's work, due to the freedom from bush fire smoke that prevailed in many places throughout the summer. Although

the month of August was somewhat erratic as to weather conditions, it was made up for in September and the survey was pushed well forward, making its completion in 1924 a certainty under conditions of average good weather. In all 61 camera stations were occupied and 540 photographic plates exposed. The field work was directly in charge of Mr. A. J. Campbell, D.L.S., assisted by Mr. A. S. Thomson.

CARCAJOU PASS

The topography of the pass is fully described in Chapter I (1922 Report of the Topographical division). The altitude of its summit is 5120 feet above sea level. There is very little difference of level within a considerable area of the morass in which the summit lies. So little difference of level is apparent, and the flow from the glacial source of the streams forming the morass is split into such a number of channels, that the only way to estimate the position of the watershed is to follow the centre of the gravel flat above the morass to where the main stream emerges from the ice tongue of the glacier at the head of the valley, then up the centre of the ice to a northern ridge of Mt. Phillips, and so to the summit of the mountain, where the course of the watershed turns easterly along the serrated ridge confining the valley of Robson River on the north side.

It is possible that this pass over the divide may in the future furnish a route to connect the Smoky River valley with the Holmes River valley, but at the present time it does not appear to be of economic importance and a detailed survey by the Commission would be a useless expense.

BESS PASS

The history and origin of the name together with its topographical features are given in Chapter I (1922 Report). The lowest altitude of the summit is approximately 5330 feet above sea level. It is covered by forest growth and would require a detailed survey to arrive at a definite altitude.

This pass of the watershed is chiefly of importance owing to the fact that the trail leading from Smoky River Valley to Jackpine River Valley lies over it. As a route for a road it is of little value on account of the rough eastern approach and the tremendously steep fall of 2000 feet or more from the summit to the floor of the Holmes River Valley on the western side. The present chief value lies in the approach it gives to the magnificent scenic features that centre around it in the great massifs of Mts. Bess and Chown and the icefields and glaciers that surround them. A detailed survey of the pass is not warranted at the present time.

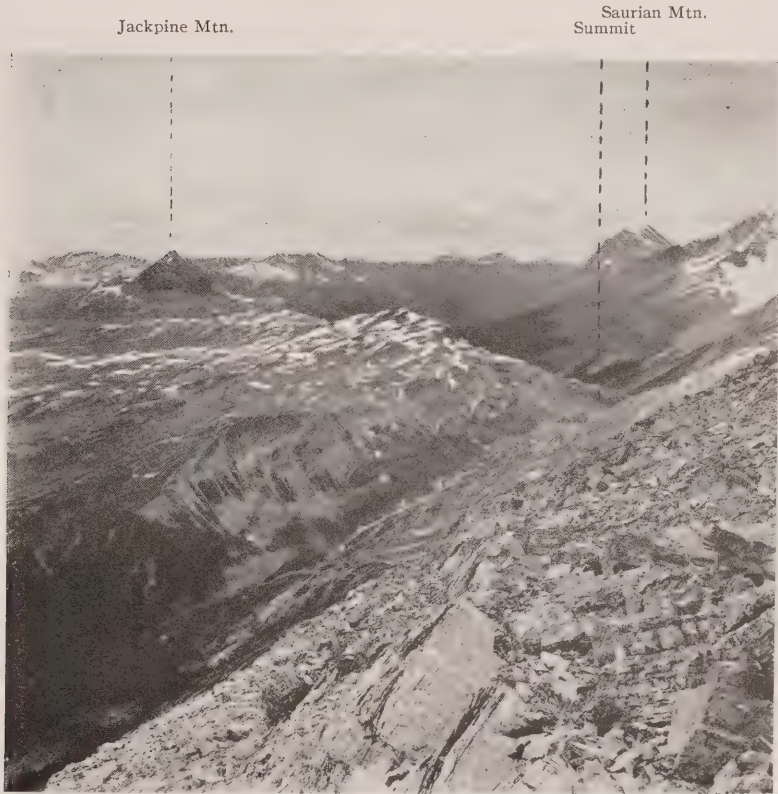
JACKPINE PASS

This pass is so named on the Jobe-Phillips map (published by the American Geographical Society, Vol. XLVII, No. 7, 1915).^{*} It is the crossing of the watershed that gives access to the head of the Jackpine River Valley; hence

^{*}The Jobe-Phillips map is the only detail map of the area covered by this chapter of the report which has been published up to the year 1922. It is compiled largely from information obtained by Donald Phillips, who was Miss Jobe's guide for her expedition of 1914, an account of which appears in the bulletin of the American Geographical Society referred to above. The map was prepared to illustrate the results of the expedition. While inaccurate in many parts it is generally speaking a fair representation.

the name. The altitude of the summit is 6694 feet above sea level and the direction is northwesterly and southeasterly. It lies at the head of a small tributary of Holmes River and is the route of travel, a very hilly one, connecting the Smoky River Valley, via Chown Creek and Bess Pass, with the Jackpine River Valley and the fine game country to the north of it.

The trail from the Smoky proceeds up the shingle flats of Chown Creek to quite near the ice tongue of Chown Glacier, where the stream has its source;



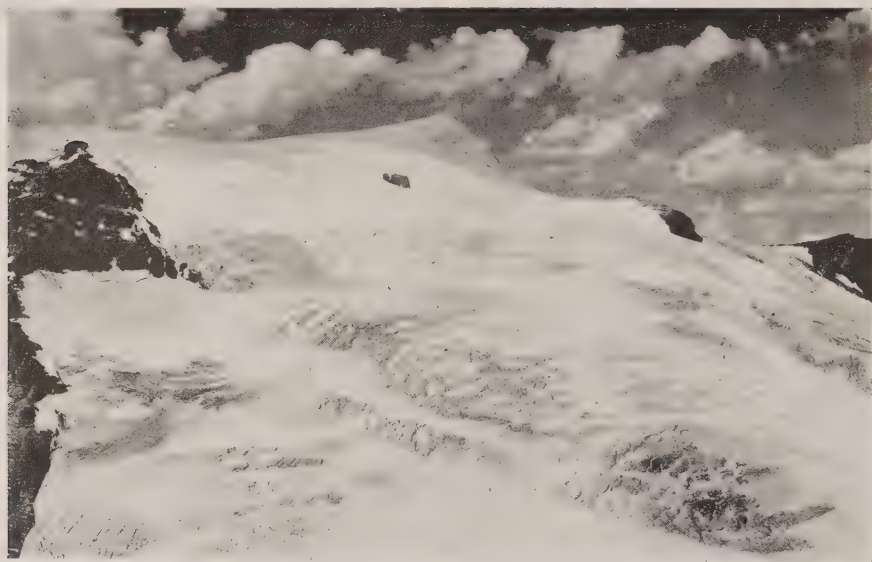
JACKPINE PASS

then climbs up the timbered slopes of a small tributary, fed by glaciers, at the summit of Bess Pass. From the summit the trail ascends steeply and crosses a southern shoulder of Mt. Bess. Keeping high up on the western slopes of the mountain it gradually descends to the floor of the valley of Jackpine Pass and crosses the pass above timber line. The approach to the summit is open and hilly and the gap a narrow one. On the Jackpine side the descent is gentle for a half mile or so and then drops very steeply to the bed of the river, which is fed by a number of spectacular glaciers lining the cirque at its head. The pass enters this cirque on the south side.

JACKPINE RIVER VALLEY

Jackpine River has its source in glaciers descending from the high mountain ridge containing the Chown Glacier and Resthaven Icefield on the southwest. The young river is soon augmented by numerous good-sized streams, chiefly flowing from the west. There is a strikingly picturesque cirque at its head with a number of broken icefalls resting in the hollows.

The general course of the river is northwest for some fifteen miles of direct distance, within which the stream loops and winds in a very sinuous manner. It then turns north and gradually assumes a northeast direction for another twelve or more miles to its junction with the Smoky River. For about six



MT. CHOWN AND CHOWN GLACIER

miles of its course the stream winds, first through cañon and gravel flat, and then wet, swampy meadowlands, beyond which the fall is greater and the flow lies for several miles in one channel between forested banks. The valley floor now opens out somewhat and meadowland spots are more frequent. At the turn the valley becomes wider and from there to the junction with the Smoky is densely forested with jackpine, the prevalence of this species of timber in the valley being likely the cause of the name of the river.

At the bend two important streams from the west join Jackpine River. The southern one is named Meadowland Creek on the map (sheet 35) and the northern stream, Pauline Creek. Meadowland Valley leads to Loren Lake Pass over the watershed and the Pauline Valley to Beaverdam and Avalanche Passes over the watershed. The last named stream parallels the main Jackpine River for a considerable distance after entering its valley, joining the main river some four or five miles from its mouth.

LOREN LAKE PASS

Meadowlands seen at the summit of the pass extend northeastward for a mile or more on the Alberta side. They provide excellent pasturage for horses and a delightful camp ground is found directly at the summit. There are here three small bodies of water. Loren Lake has a very picturesque setting. It lies a quarter of a mile south of the summit on the British Columbia side, is five-eighths of a mile long, and has a maximum width of an eighth of a mile. The lake is almost entirely surrounded by forest. To the north the valley opens to the meadowlands referred to but to the south, with the exception of a few patches of meadow, is densely timbered and soon assumes a steep grade

Saurian Mtn.



SWAMPY MEADOWS IN JACKPINE RIVER VALLEY

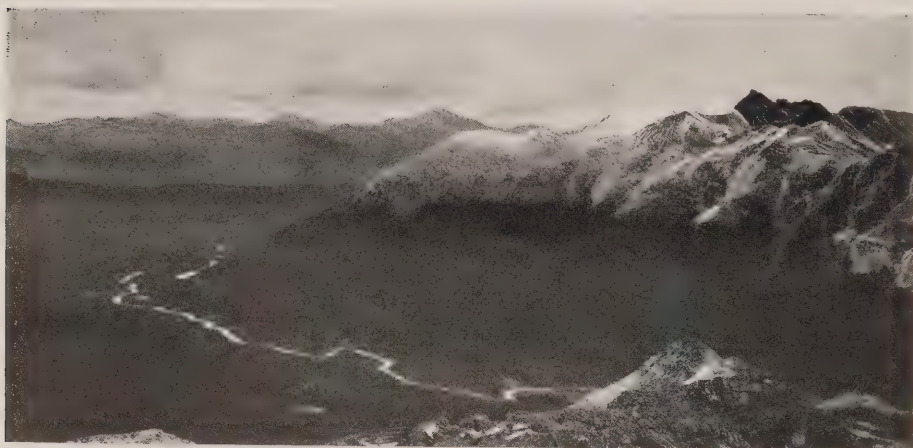
to Chalco Creek Valley of which it is a tributary. Close by the summit of the pass a small stream comes down from the northwest and flows to Loren Lake. A quarter of a mile from the summit, on the northern side, is another smaller tarn, about a quarter of a mile long and a sixteenth of a mile wide, and almost at the summit, but on the British Columbia side, is a small pond.

The direction of the pass at the summit is northeasterly and southwesterly and the altitude 5059 feet above sea level. The approach from the northeast is of easy grade as a whole, but a cañon in the bed of the stream and a series of rock ledges make it necessary to climb high up on the northern slopes and then descend to the meadowlands above the cañon, a somewhat rough way. The length of Meadowland Creek Valley from its junction with the Jackpine Valley to the summit of the pass is very little over five miles. The pass would appear to be of slight economic value for travel at the present time and no

used trail leads over it. Some two and a half miles from the Jackpine a branch stream comes down from the northwest. It heads in a pass leading to the valley of Pauline Creek and is named Jones Pass on the Jobe-Phillips map. Its greatest altitude is about 6200 feet and the grade is very steep on both sides of the summit. Jones Pass leads over an Alberta watershed and is not on the Great Divide.

BEAVERDAM PASS

This pass over the watershed is so named on the Jobe-Phillips map. The name is due to evidences of beaver-dams and houses seen at the time of their exploration in 1914. No signs of beaver were now seen around the small tarn



JACKPINE RIVER VALLEY BELOW THE BEND

close to the summit of the pass on the Alberta side of the watershed, or in the small stream flowing from it. They seem to have either been trapped out or to have left the locality.

Beaverdam, Avalanche and Jones Passes are at the headwaters of Pauline Creek. Approximately 14 miles from its junction with the Jackpine, a stream named Beaverdam Creek from Avalanche and Beaverdam Passes unites with Pauline Creek, the headwaters of which are in Jones Pass and the area south of Mt. Pauline. Pauline Creek has evidently the greater volume of flow and is shown on the map as the main stream. Two and three-quarters miles beyond the junction Beaverdam Creek is joined by Avalanche Creek leading north-westerly some three miles to the summit of Avalanche Pass. Beaverdam Creek has its source three-quarters of a mile westerly in a small tarn near the summit of Beaverdam Pass.

The valleys of the streams forming the headwaters of Pauline Creek show wide, open meadow bottoms on the eastern side of the watershed. On the western side there are broad stretches of old brûlé with scattering bunches of

green timber, or else heavy forest growth. The stream from the west side of Beaverdam Pass, within two miles, joins Renshaw creek, a strong-flowing tributary of Morkill River.

The direction of the pass at the summit is N.E. and S.W., and the altitude is 4974 feet above sea level. It is dominated by Mt. Pauline 8704 feet in altitude, which lies almost due south two and three-quarters miles distant.

Summit

Mt. Pauline



LOREN LAKE PASS

AVALANCHE PASS

The name is taken from the Jobe-Phillips map. The direction of the pass is N.W. and S.E. and the altitude 5195 feet above sea level. In direct distance it lies, slightly west of north, three miles from Beaverdam Pass.

The summit is in an open meadow similar to those already described. The approach from the south is very gradual but, on the north or British Columbia side, it soon becomes steep and very densely forested.

The reason for the name is unknown but may be due to a snow-slide that happened close by the summit of the pass many years ago and has left some rotting débris of the timber it swept down at the time. It is not a spectacular slide and but slight indication of it is left to tell the tale. There are no other indications of avalanches in the immediate vicinity. Avalanche Creek, the

stream from the pass flowing southeast is one of the heads of Pauline Creek and, on the opposite side, a small tributary flows to Morkill River. The summit of the pass is dominated on the southwest by Interpass Ridge and on the northeast by Avalanche E. camera station.

MORKILL PASS

The summit of Morkill Pass divides the waters of Morkill River from those of Muddywater River. The Morkill is a tributary of the Fraser River, heading

Summit

Chalco Mtn.



LOREN LAKE AND PASS

in a broad, heavily-timbered basin, contained by a wide loop eastward of the watershed. There are a number of minor branches of the stream heading in this basin and strong-flowing tributaries along its course soon swell the volume to a considerable size.

The summit of the pass is at the head of a minor tributary which, flowing from the northeast, joins the main stream some five miles from its ultimate source. Above the junction the valley trends southeast and south to the watershed.

The direction of the pass at the summit is nearly due east and west, and the altitude is 5434 feet above sea level. The summit lies in an open meadow with small ponds here and there along its western margin.

The Muddywater, after a northern flow of some five miles or so, is joined by Fetherstonhaugh Creek and then, on a course a little south of east, the united streams flow some fifteen or more miles to a junction with Smoky River.

The general character of the country presents numerous shallow valleys separated by low, open ridges of shale culminating in rocky crests, with higher

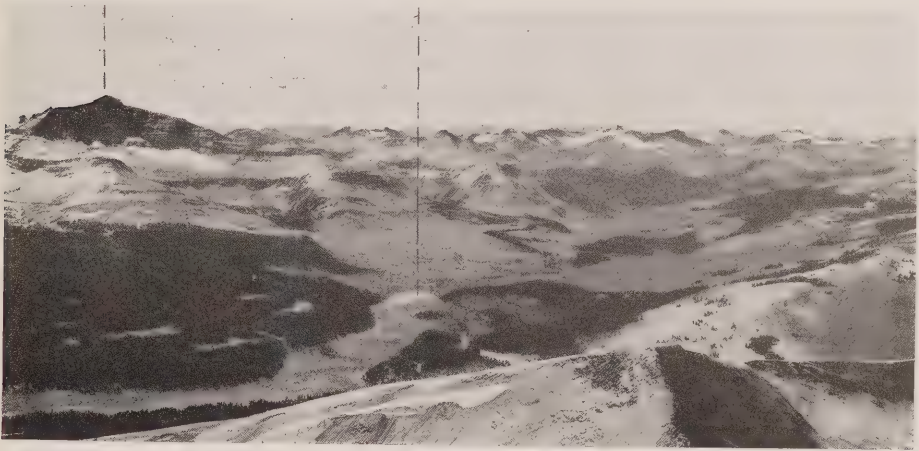
peaks and points rising at intervals above the outline. Open meadows are seen at most of the valley bottoms, with sparsely scattered timber in belts and groves, or in isolated bunches, rising to timber line only a short distance above the valley floor. As the valleys fall in altitude they become more densely forested and the meadowlands less frequent.

GENERAL REMARKS

Watershed.—Leaving the summit of Mt. Phillips, on a northward course, the watershed descends a steep north ridge and then, crossing the icefield below the main rock mass of the mountain, descends the glacier which forms the joint

Mt. Pauline

Summit



BEAVERDAM PASS

source of Holmes River and Carcajou Creek. The direction is generally north and the distance two and a quarter miles. From the foot of the glacier the watershed follows the bed of the stream, which is traversed by many channels, to the morass wherein the summit of Carcajou Pass lies. Here, the many channels of the stream divide their flow, the greater volume of water going northwest to form Holmes River, a tributary of the Fraser, and the balance north to form Carcajou Creek, a tributary of Smoky River. On this course the bearing is N.N.W. for one and three-quarters miles to the approximate summit of the pass; its actual location in the morass is indefinite for the reason that practically the same level extends over a considerable area.

The head of the valley is a wonderfully picturesque spot. Glaciers fall in a fine circle from icefields by which the cirque is surrounded, on the west side merging with the broad icefields below Whitehorn Mtn. and Mt. Longstaff. These ice areas send down several tributary glaciers, showing magnificent broken icefalls which make the head of the valley of specially spectacular scenic interest.

Whitehorn Mtn. (11,130 feet), Mt. Phillips (10,660 feet) and Mt. Longstaff (10,440 feet) dominate the fine glacial cirque.

From the summit of Carcajou Pass the watershed continues in the same direction (N.N.W.), on a somewhat erratic course, for nine miles to the summit of Bess Pass. The direct distance between the two summits is very nearly seven and a half miles.

Holmes River valley lies almost parallel along the west side of the watershed as far as the junction of a small tributary from Bess Pass summit, which has a run of about two and a half miles. The fall from the summit is very steep, about 1500 feet, and the valley is densely forested. A short distance beyond

Summit



MORKILL PASS

the junction the Holmes River turns on a course slightly south of west and a number of strong-flowing tributaries soon make it a stream of very considerable volume.

On the east side of the watershed lie the respective basins of Carcajou Creek and of a small stream flowing northeast from the summit of Bess Pass to join Chown Creek in little more than a mile of distance. The two basins are separated by a high rock ridge holding several large glaciers on the north side.

Chown Creek is fed by the broad extent of the Chown Glacier. It is a strong, swift-flowing torrent and is split up into many channels winding through a gravel bed for the entire distance of its run of about five miles. Bess Pass is dominated on the north by Mt. Bess (10,550 ft.) and on the south by White-shield Mt. (8807 feet). The watershed crosses both these summits.

The area described above, lying between the Holmes and Smoky Rivers, Chown Creek and the valley of Bess Pass, as well as the area mapped west of Holmes River, has been covered by the following camera stations: In 1922 by Chown Creek S. Nos. 1 and 2; Bess S.E.; Bess S.W.; Mt. Jess; and Carcajou

Creek N., previously mentioned in Chapter I of this report. In 1923 by Phillips N., 8321 ft.; Carcajou Pass W., 8265 feet; Carcajou Pass N., 8194 feet; Holmes Valley W., 7844 feet; Holmes Valley Overlook, 8120 feet; and Whiteshield Mt. 8807 feet.

From the summit of Bess Pass the same general course, N.N.W., is continued by the watershed for one and three-eighths miles up the steep, southern precipices of Mt. Bess to the summit ridge. It then traverses a northwestern ridge of the mountain for two miles to the elevation on which Jackpine Pass E. camera station (9569 feet) is set, but shortly before arriving there the watershed turns very nearly at right angles and, crossing the summit of Jackpine Pass on a southwest course, ascends to Jackpine Pass W. camera station (7727 feet) at a distance of one and three-quarters miles. The summit of the pass is reached at one and a quarter miles.

The northwest ridge of Mt. Bess, the one followed by the watershed, separates the valley of Jackpine Pass from that of the Chown Glacier. The ridge shows alternating elevations and depressions of which the highest altitude is 10,200 feet. In direct distance, the summit of Jackpine Pass is three and three-quarters miles northwest of the summit of Bess Pass.

From Jackpine Pass W. station the general course of the watershed lies a little north of west for eight miles, crossing Alpland E. camera station (7120 feet) at two miles and the summit of Jackpine Mt. (8400 feet) at five and three-quarters miles. Although the general course is a little north of west the actual course is erratic, deviating in loops and bends from the line of direction at various places.

Beyond the end of the eight-mile stretch the watershed loops southward for three and one-eighth miles to a point close by the summit of Mt. Holmes (8217 feet). It then resumes its previous general north of west direction for five and a half miles to a point very nearly due east of Chalco Mt. (8524 feet), distant one and a quarter miles.

From Jackpine Pass westward the courses of the Jackpine and Holmes Rivers parallel one another, diverging slowly as they proceed. The watershed lies between, first closer to the Jackpine Valley and beyond the southern loop to the Holmes Valley. Between the streams lies a broad area of hilly country with a number of elevations rising to outstanding heights, of which Jackpine Mt. is the highest. Many streams on both sides of the watershed have carved out deep valleys tributary to the valleys of the main waterways. All show more or less forested bottoms, but the valleys of the Holmes River and its tributaries, on the British Columbia side of the watershed, are for the most part densely timbered. The hillsides show much open alpland and many shale slopes, with the higher elevations rising in rocky crests. The northern escarpment of the Jackpine Valley and the southern escarpment of the Holmes Valley are more rugged and the heights beyond rise as mountains, showing many icefields and glaciers, some of considerable size.

At the last mentioned point, one and a quarter miles east of Chalco Mt. the watershed turns sharply at right angles and runs on a general north-northwest course crossing the summit of Preseverance Mt. (7959 feet) at four miles and reaching the summit of Loren S. camera station (7627 feet) at seven and a half miles. The watershed now approaches more closely to Jackpine River, which here turns north and east, Holmes River continuing westward and diverging rapidly from it.

Mt. Robson



GLACIAL CIRQUE AT HEAD OF HOLMES RIVER AND CARCAJOU CREEK
(LEFT HALF OF PANORAMA)

From Loren S. camera station the watershed loops northeast and northwest to the summit of Loren Lake Pass, distant two and a half miles, and continues up the opposite slopes.

Between the point east of Chalco Mt. and Hughes camera station many small tributaries flow to Jackpine River, of which Spider Creek and Meadowland Creek are the most prominent. On the western side Chalco Creek heads from glaciers on the northeastern slopes of Chalco Mt. and, flowing northwesterly,

is joined by the stream from Loren Lake near the summit of the pass. It then turns west and south in a densely forested valley and joins the Holmes River many miles farther on. In direct distance the summit of Loren Lake Pass lies eighteen and three-quarters miles northwest of the summit of Jackpine Pass.

To cover the area between Jackpine Pass and Loren Lake Pass, between the Jackpine and Holmes Rivers, and the part mapped east of Jackpine River the following camera stations were occupied: In 1922 Bess S.E., 8219 feet, and

Mt. Phillips

Whitehorn Mtn.



GLACIAL CIRQUE AT HEAD OF HOLMES RIVER AND CARCAJOU CREEK
(RIGHT HALF OF PANORAMA)

Bess S.W., 8460 feet; in 1923 Bess Shoulder, 8477 feet; Whistler E., 7465 feet; Bess Pass W. No. 1, 7195 feet; Bess Pass W. No. 2, 7141 feet; Jackpine Pass W., 7727 feet; Jackpine Pass E., 9569 feet; Whistler, 7585 feet; Alpland E., 7120 feet; Alpland W., 7230 feet; Jackpine Mt., 8400 feet; Mt. Holmes, 8217 feet; Holmes N., 7824 feet; Barricade Shoulder, 8506 feet; Pigmy, 8745 feet; Chown N., 8639 feet; Resthaven Mt., 10,253 feet; Draco Pk., 8489 feet; Jackpine Bend No. 1, 7440 feet; Jackpine Bend No. 2, 7357 feet; Chalco Mt.,

8524 feet; Perseverance Mt., 7959 feet; Spider, 7688 feet; Loren Overlook, 7700 feet; Loren S., 7627 feet; and Loren Junction, 7706 feet.

From the summit of Loren Lake Pass the watershed lies northwest for a little over one and a half miles to Hughes camera station (7293 feet), where it swings sharply southwest for one and three-quarters miles to near Pauline S. camera station. It then again turns northwest for one and seven-eighths miles, and then north for one and a quarter miles to the summit of Mt. Pauline

Mt. Phillips



ICEFIELDS AND GLACIERS AT HEAD OF HOLMES RIVER AND CARCAJOU CREEK
(LEFT HALF OF PANORAMA)

(8,704 feet). From Pauline it lies northeast for one and five-eighths miles, which brings it back to a general northwesterly direction in line with Hughes camera station. The loop here described contains the headwaters of Pauline Creek. On the western side tributaries of Chalco Creek, flowing to Holmes River, and of Renshaw Creek, flowing to Morkill River, have their rise.

At the last mentioned terminal point the watershed swings two and three-eighths miles north and northwest to the summit of Beaverdam Pass. The

stream on the east side together with that from the little tarn near the summit of the pass unite to form Beaverdam Creek, a tributary of Pauline Creek. On the west side the water flows to Renshaw Creek. The summit of Beaverdam Pass is six miles in direct distance northwest of the summit of Loren Lake Pass.

From the summit of Beaverdam Pass the watershed continues on a northwest course for a distance of very nearly three miles to a point on Interpass Ridge between Interpass camera stations Nos. 1 and 2, but nearer the latter. En route it passes over the No. 1 station (7386 feet). It now turns at right

Mt. Longstaff



ICEFIELDS AND GLACIERS AT HEAD OF HOLMES RIVER AND CARCAJOU CREEK
(RIGHT HALF OF PANORAMA)

angles and on a northeast course descends steeply to the summit of Avalanche Pass, distant one mile. On the Alberta side Avalanche Creek flows three miles southeast to join Beaverdam Creek, and on the British Columbia side the stream flows northwest to Morkill River. The summit of Avalanche Pass is three miles in direct distance north-northwest of the summit of Beaverdam Pass.

The watershed now zig-zags nearly due east for a little more than one and a half miles to the crest of a ridge on which Avalanche Pass E. camera station (7099 feet) is set, a little more than a quarter of a mile to the northwest. From the crest it describes a loop slightly south of east for a little more than two

and a quarter miles to Beaverdam Overlook camera station (7894 feet). Beyond that point the watershed winds in a general east-southeasterly direction to Morkill Pass, its course from the terminal point on Interpass Ridge as far as described forming part of a great easterly loop around the headwater's basin of Morkill River. Southward the drainage flows to Beaverdam and Pauline Creeks. The summit of Morkill Pass lies northeast of the summit of Avalanche Pass and is seven and one-eighth miles from it in direct distance.

More detailed description of this part of the watershed is given in the report of the 1924 operations, in the area covered by sheet No. 37 of the Atlas of Maps, Part III.



NORTHERN HALF OF RESTHAVEN ICEFIELD
(LEFT HALF OF PANORAMA)

To cover the country between Loren Lake Pass and Avalanche Pass, and east and west of the watershed between their summits the following camera stations were occupied: Pauline S. No. 1, 7402 feet; Pauline S. No. 2, 7175 feet; Hughes, 7293 feet; Jones Pass W., 7362 feet; Jones Pass N., 7637 feet; Courier, 7877 feet; Mt. Pauline, 8704 feet; Mt. Renshaw, 7867 feet; Swanson, 7475 feet; Interpass No. 1, 7386 feet; Interpass No. 2, 7535 feet; Avalanche Pass E., 7099 feet; and Beaverdam Overlook, 7894 feet.

Trails.—There are a number of routes giving access to the mountain district north of Mt. Robson. All of them are difficult for travel but some are distinctly bad. The eastern route by way of Snake Indian River, a tributary of the Athabaska north of Jasper, and Sulphur River to Smoky River is probably

the best and easiest, for the principal reason that there is a better supply of horse feed than by any of the other routes.

Another trail leads from Yellowhead Pass, via Miette, Grant, Colonel and Moose Passes, all over the Great Divide, to Smoky River. It is a bad trail, though very picturesque, with a number of long, steep hills. A third trail leads from Mount Robson Station to Robson Pass and across the Great Divide to the head of Smoky River. These three trails have the same objective of Smoky River. A trail leads down that stream and several minor trails branch from it at various points to reach the interior of the country adjacent to it. That branch via Chown Creek and Bess Pass is the one giving access along the watershed, and is a very bad line for travel. It crosses Jackpine Pass and leads down the Jackpine Valley, and is undoubtedly the worst and most difficult of them all. After crossing many swamps and mud-holes it passes through woods



NORTHERN HALF OF RESTHAVEN ICEFIELD
(RIGHT HALF OF PANORAMA)

along the edge of the stream, where rocks with mud-holes between them endanger life and limb. Leaving the Jackpine Valley it crosses a high ridge between Meadowland Creek and Pauline Creek, proceeding up to the top and down the other side—an execrable trail!—then over the Great Shale Hill, and so into a country of lower elevations, where meadowlands and open grassy slopes abound and the travelling becomes much easier. There is here a fine hunting country and once reached it is thoroughly enjoyed.

The fourth entrance to this section is from McBride in the Fraser Valley, a village on the Canadian National railway west of Jasper. The trail gives access to the same area of country and joins the previous trail at the Great Shale Hill. It passes immediately to the south of Mt. Renshaw and down Renshaw Creek to branch off via Beaverdam Pass and so to join the Jackpine Valley route.

The trails are used almost exclusively by tourist and hunting parties. A few surveying parties and prospectors occasionally travel over them. As a whole, access to the area surveyed is arduous. The existing trails are bad—in some cases very bad. The routes seem to have been selected with poor judgment and follow what were the lines of least resistance, in so far as cutting out of forest growth was concerned. The result is that they have been carried over many of the higher hill slopes, above the dense timber, entailing much steep climbing.

Notwithstanding the many difficulties the region attracts tourist and hunting parties. They go in frequently from Jasper, Mount Robson and McBride, and brave the horrible trails and stupendous hills with every evidence

Mt. Chown



SOUTHERN HALF OF RESTHAVEN ICEFIELD. DRAINS TO SMOKY RIVER
(LEFT HALF OF PANORAMA)

of enjoyment. The instinct seems to be to get into the unknown, primeval wilderness, and the beautiful park-like valleys north of Jackpine River when reached are worth the labour for both nature lovers and big game hunters.

Rivers and Streams.—The two main waterways receiving the drainage of the area covered by this chapter of the report are the Smoky River on the eastern side and the Fraser River on the western side of the watershed. The former is a tributary of Peace River which drains to the Arctic Ocean and the latter flows to the Pacific Ocean.

Of the drainage referred to above east of the watershed, Jackpine River, with its tributaries Meadowland Creek and Pauline Creek (West Branch), flows into Smoky River. West of the watershed, Holmes River, with its tributaries Chalco Creek and Morkill River, flows into the Fraser. There are many

other minor streams flowing to one or other, or to their branches, in every direction.

The Smoky River has its primary source in extensive ice-fields and glaciers in the vicinity of Mt. Robson. It soon becomes of very considerable volume and is a swift-flowing, muddy torrent, divided into many channels in the wide gravel flats that form its bed. The route of travel lies along these gravel flats and much fording has to be done, often during high water which is both difficult and dangerous.

On the other hand Jackpine River and its tributaries receive their supplies in the main from marshy sources and for the most part present a clear water flow.



SOUTHERN HALF OF RESTHAVEN ICEFIELD. DRAINS TO SMOKY RIVER
(RIGHT HALF OF PANORAMA)

Holmes River takes its initial supply from the extensive icefields and glaciers at the head of Carcajou Pass valley and from many others along its course. It is a swift, muddy stream, flowing in a deep, densely timbered valley with a narrow bottom which, in so far as it came within the ken of the survey, did not appear to open out much in gravel flats. Morkill River also, as far as could be seen, flowed in a narrow densely timbered valley of a like character to that of Holmes River.

Timber.—In this section timber line does not reach much over 6000 feet above sea level and, consequently, it lies not far above the valley bottoms. The usual species were seen: on the Alberta side spruce and balsam at the heads of the valleys and high up near timber line; at lower altitudes lodgepole pinus (*Pinus Murrayana*) intermingled with spruce. The prevalence of pine as one

travels northward becomes apparent, particularly in the valley of Jackpine River at its lower reaches. As one proceeds northward open meadowlands in the valleys, dotted with clumps and belts of timber, present a park-like appearance that is very pleasing. In these beautiful, open sun-lit meadows one looks to see herds of deer and other wild animals browsing peacefully and, although few were seen at the time of the survey, it is reported that late in the fall before winter sets in they may be seen in considerable numbers.

The valleys of the streams on the British Columbia side are densely forested and from appearance they should contain bodies of good merchantable timber. While some patches of good sized timber were noticed in various places no extensive stands were seen so near the heads of the valleys. It is quite likely that lower down in the valleys of the larger streams timber stands of good economic value may be found, but their value would be governed by the facilities offered by the said streams to take out logs.

A number of areas of ancient brûlé were noticed, chiefly on the British Columbia side. The fact that they are so located is likely due to the denser growth offering greater opportunity for ravages by fire. The growth on the eastern slopes of the watershed being more scattered and more separated by open spaces would not present the same facilities.

Game and Fish.—Generally speaking, the area described above is a good game country and many hunting parties visit it in the fall and obtain good sport beyond the Jasper Park limits, within which hunting is prohibited.

Moose are plentiful in the more heavily timbered areas where marshland and scattered ponds abound, as at the head of Holmes River and Carcajou Creek, and in the upper reaches of the Jackpine Valley, where wide swampy meadows provide good feeding grounds. Moose may here be seen standing knee-deep in the ponds, with their heads under, feeding on aqueous plants. Woodland caribou are plentiful and are seen on the open ridges and in meadows along the forest margins. In the late fall and early winter, when the frost has killed the herbage higher up, they are seen in the lower meadows in bunches.

Mountain sheep can be found along the shale and rocky ridges at the heads of Muddywater River and Sheep Creek, just north of the area covered by the surveys of the past season. Mountain goats can always be found high up on the summits of the ridges during the summer but come down lower in the fall when feed gets scarce at greater heights. Small deer are in all the woodlands and are frequently seen. Bear, both brown and grizzly, are to be met with occasionally, and seem fairly numerous. The grizzly is more frequently seen on the British Columbia side of the watershed where the formation is more rugged and the forest growth thicker.

Some beaver houses, dams and cuttings were seen in the more swampy valleys, such as at the heads of the Jackpine and Holmes Rivers, and of Carcajou Creek, but to no great extent. They are doubtless to be seen in other valleys, especially on the British Columbia side of the watershed, but only in isolated

cases and no beaver colonies were met with. There is doubtless a certain quota of fur-bearing animals, for trappers' cabins and trap-lines were noticed in a few of the valleys, but no fur-bearing animals were seen.

Fish are reported in Sheep Creek, north of the area surveyed, and as they would have to reach Sheep Creek by way of the Smoky River, of which it is a tributary, they would likely be found in the tributaries above Sheep creek, if properly fished for, which the survey party had no time to do. Trout are plentiful in Grant Brook, a tributary of Fraser River, and consequently should also be found in other tributaries of that waterway which join it below Grant Brook. As a rule fish are not plentiful so near the glacial sources of the streams owing, likely, to a scarcity of suitable food and the turbid condition of the waters, due to silt carried from the ice and not yet deposited.

MAPS

Additional information was obtained during the season to complete sheet No. 32, and sheets Nos. 33, 34, 35 and 36 were also completed. Information for part of sheet No. 37 was obtained but it was held for completion at the close of the 1924 surveys.

The season was a good one and full results were obtained. During July and August rain and snow hindered the work to some extent, but these storms at intervals served to keep down the forest fires, and smoke, such as had been experienced the previous summer, was not in evidence, so that photographing was carried on to advantage. Sixty-one camera stations were occupied and 509 views obtained.

CHAPTER III

TOPOGRAPHICAL SURVEYS EXECUTED IN 1924

The field work of the boundary survey between the provinces of Alberta and British Columbia was completed during the season of 1924, in so far as it was considered necessary to carry it on under the present commission. It now only remains to establish on the ground the 120th meridian from near the north boundary of Township 97, where the survey was discontinued by Mr. R. W. Cautley's division in 1923, to the 60th parallel of latitude, which forms the north boundary of the respective provinces, a distance of approximately 175 miles. This northern tract of country, through which the meridian has yet to be surveyed, lies in an uninhabited area and there appears to be no immediate need for the establishment of the boundary.

During the season of 1924 Mr. Cautley's division was engaged in surveying and establishing the 120th meridian south from monument 61-4, close to the summit of Mt. Torrens which was the most southerly monument established by him in 1922. The meridian was produced south for 33.9 miles to monument 56-0, established at the intersection of the meridian with the summit watershed of the main range of the Rocky Mountains. Such intersection occurs at the crest of a mass which has been given the name of Intersection Mountain. It is an elevation of the watershed 8075 feet in altitude, about two miles south of Sheep Creek, and the intersection is within 100 feet of the highest point of the mass. In the distance stated, Mr. Cautley established fifteen monuments on conspicuous points of the line. Full details of this part of the season's work will be found in Mr. Cautley's report, which is contained in Part III-B of this report.

At the close of the survey of the meridian Mr. Cautley, in conjunction with Mr. Wheeler, surveyed Robson and Miette Passes and established the boundary across their summits. His report of the survey will be found farther on under the names of the respective passes.

Mr. Wheeler's division commenced work where it had been discontinued in 1923 and continued the photo-topographical survey of the watershed and vicinity northwards to Mt. Torrens (where Mr. Cautley had carried the survey of the 120th meridian in 1922), thereby completing the topographical survey of the Interprovincial boundary from the International boundary (the 49th parallel of latitude) to connect with Mr. Cautley's topographical survey along the 120th meridian at Mt. Torrens.

GEODETIC SURVEY TRIANGULATION

The triangulation of the Geodetic Survey, to connect the Dominion Lands survey system at Yellowhead Pass with the 120th meridian at its intersection with the main watershed of the Rockies, was as heretofore in charge of Mr. H. F. Lambart, D.L.S. Four parties were placed in the field and the angle reading at the various stations of the triangulation was completed.

In addition a party, under Mr. F. A. McDiarmid, of the Geodetic Survey, laid out a base line in Sheep Creek valley at the northern extremity of the triangulation and measured the same by precise methods. The base is 3.005 miles in length and from end to end lies along open and practically level meadowlands. He also established the exact longitude of the eastern end of the base and marked the same by erecting a concrete pier. The work was done with the help of radio apparatus, recording the time direct from Washington. It was found to give adequate results.

The field work of the triangulation was duly completed and the objects in view, viz., that of connecting widely separated extreme points of the land surveys, and that of supplying data to place the Interprovincial Boundary in true position have been accomplished. Mr. Lambart's reports of the work will cover the details in full.

TOPOGRAPHICAL DIVISION—DESCRIPTION OF OPERATIONS

Organization was effected at Jasper, and the usual tests of cameras and for speed of plates made for the photo-topographic work.

The party, in charge of Mr. A. J. Campbell, D.L.S., with Mr. N.C. Stewart, D.L.S., as assistant instrument man, started for the scene of operations on June 23rd and travelled via the Snake Indian River trail to Smoky River, thence via Bess Pass and the Jackpine Valley to Casket Pass, where the work had been discontinued the previous season, arriving there on July 8th.

Between July 9th and 15th seven stations were occupied. From July 16th to July 31st thirteen stations were occupied, notwithstanding the fact that the latter part of the month was stormy with frequent rains and low clouds obscuring the landscape, a condition of affairs highly detrimental to work depending upon the obtaining of good photographic views.

On July 27th Mr. Campbell started for Mt. Robson to attend the unveiling ceremony of the special monument erected at the summit of Robson Pass to commemorate the survey of the Interprovincial boundary. Mr. Campbell arrived back at his camp on August 14th. During his absence Mr. Stewart was in charge of the work which was carried forward continuously.

Between July 31st and August 14th eight stations were occupied. Much stormy weather with rain, snow and low clouds occurred during the latter part of August but, notwithstanding, twenty stations were occupied and the work pushed through to Mt. Torrens.

September 1st to 6th the party moved back to Sheep Creek Valley and camped at a charming little lake near the summit of the pass. En route four additional stations were occupied and the programme of the survey completed with the exception of a few intervening stations that had been left behind owing to unsuitable weather conditions.

Mr. Wheeler arrived at Sheep Pass on September 6th, having completed the work with Mr. Cautley at Robson Pass. Bad weather again interfered until the 11th when two stations at Sheep Pass summit were occupied and, on the 12th, three others in the vicinity. Camp was now moved down the valley of Sheep Creek and the two final stations occupied on the 13th. On the 14th a move was made for Miette Pass, where Mr. Cautley was working.

Summit of Pass



FETHERSTONHAUGH PASS

Owing to snow storms the party was held up for four days en route and did not arrive at Miette Pass until September 25th. Much snow had fallen for the time of the year and, on September 26th, had reached a depth of twenty-one inches in the valley bottom at the pass summit.

On September 26th Mr. Wheeler went over the survey work at Miette Pass with Mr. Cautley. It was well advanced, but the work of making the survey and building monuments in such mountainous country while under snow made progress slow and laborious.

The Topographical division arrived back at Jasper on September 27th and the party was paid off on the 29th.

FETHERSTONHAUGH AND FORGETMENOT PASSES

Morkill Pass is described in Chapter II-A. The summit of Fetherstonhaugh Pass lies west-northwest of Morkill Pass and is three and nine-tenths miles from it in direct distance. By the watershed, which is very erratic, the distance is

six miles. The summit of Forgetmenot Pass lies north-northwest of Fetherstonhaugh Pass and is practically three miles from it in direct distance, but by the watershed the distance is six miles.

The headwaters tributaries of Fetherstonhaugh Creek provide two low crossings over the watershed. The southern one separates the flow of Fetherstonhaugh Creek from that of a tributary of Morkill River. The general direction of the crossing is north and south, and the altitude of its lowest point is 5924 feet. The pass summit is generally open with scattered patches and bands of small spruce and balsam scrub. The watershed here lies nearly due west and rises to Fetherstonhaugh W. camera station at an altitude of 7663 feet, changing soon after to a northerly direction. Not far below the summit the respective

Summit of Pass



FORGETMENOT PASS

valleys become heavily forested, with open spaces along the bottom on the Alberta side. The travelled trail crosses the summit of the pass in a north-westerly direction.

The northern crossing separates the flow of Fetherstonhaugh Creek from that of Forgetmenot Creek (named after the flowers, a large number of which are found in the open spaces at the head of the creek). The valley of the pass at its summit is a beautiful alpine one, with wide open meadowlands and scattered bunches of small spruce and scrub balsam here and there. Two charming little lakes drain to Forgetmenot Creek and are the most distant source of the stream. The trail, having crossed the ridge on the south side of the valley, traverses the meadowland in the midst of the open and follows a small tributary of the same stream to the valley of Casket Creek, passing to the east of a small lake near the summit of Casket Pass. The altitude of the summit of Forgetmenot Pass is 5899 feet and the general direction of the crossing northeast and southwest.

CASKET PASS

The watershed crosses the pass at a lowest altitude of 5386 feet. The general direction of the pass at the summit is northeast and southwest. On the British Columbia side Forgetmenot Creek flows to Morkill River, and on the Alberta side Casket Creek is a tributary of Sheep Creek. The summit of the pass is two and one-third miles in direct distance northwest of Forgetmenot Pass.

The summit lies some 500 feet southwest of the little lake by which the trail passes, referred to above, and the watershed then ascends to the northeast ridge of Intersection Mountain and passes over the highest point of the mass. Some fifty feet west of this point the 120th meridian intersects the watershed,

Summit of Pass

Intersection Mtn.

Mt. Buchanan

Bastille Mtn.



VALLEY OF CASKET PASS

and thereafter the meridian, on its northern course, becomes the boundary between the two provinces.

The valley of the pass is of a delightfully alpine character, showing wide tracts of open meadowland interspersed with groves of small spruce, balsam and pine, and patches of willow scrub. The eastern slopes of the valley are fairly well forested, but more sparsely so on the western slopes, and the slopes below Casket Mountain are covered by old brûlé. Casket Mountain lies directly northeast of Intersection Mountain and is an extension of the same ridge. The name is due to a rock outcrop at the summit which bears a resemblance to a sarcophagus. The name has also been applied to the stream directly below the mountain, which flows from the little lake at the pass summit. Directly across the valley, on its eastern side, rise the peaks on which Casket Pass and Sheep Creek South camera stations are set.

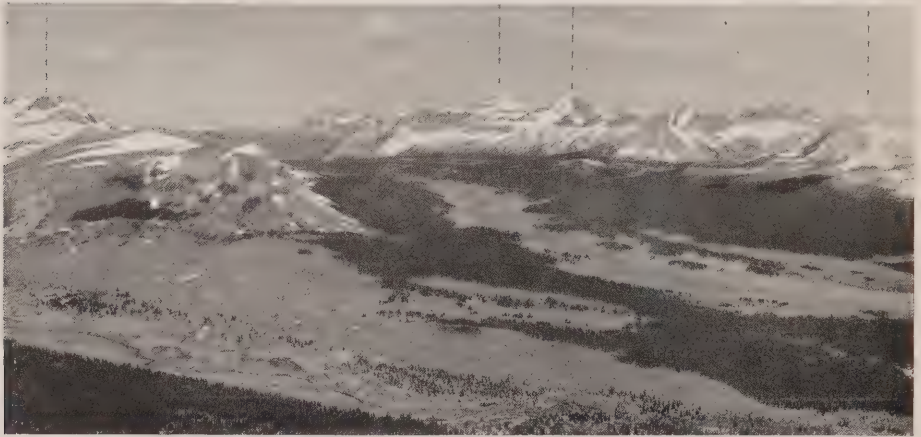
The ridge of Intersection and Casket Mountains separates the valley of Casket Pass from the Valley of Sheep Pass. The former is a boundary pass, but the latter, lying west of the 120th meridian, is wholly in British Columbia.

The valley soon becomes rugged and of more narrow dimensions, and is thickly forested while the stream, fed by many tributaries from ice and snow deposits, becomes a swift flowing torrent.

The travelled trail, on leaving the little lake at the head of the pass, crosses the valley and follows the western slopes to the north end of Casket Mountain below which it crosses over to Sheep Creek Valley.

To cover the country between Morkill Pass and Sheep Pass the following camera stations were occupied in 1923: Mt. Talbot, 7787 feet; Mt. de Veber, 8454 feet; Mt. Forget No. 1, 6804 feet; Mt. Forget No. 2, 6959 feet; Palix, 7862 feet; Redband, 7424 feet; Ptomaine No. 1, 7171 feet; Ptomaine No. 2, 7180 feet; Crescent, 7552 feet; Fetherstonhaugh W. No. 1, 7645 feet; Fetherstonhaugh

Mt. Buchanan
Intersection Mtn. Mt. Sir Alexander Mt. Ida



SHEEP CREEK VALLEY AND SHEEP PASS

W. No. 2, 7663 feet; Mt. Sprague, 8314 feet; Bowlen, 7071 feet; Hank, 7288 feet; Morkill, 7092 feet; Mt. Fetherstonhaugh No. 1, 6558 feet; Mt. Fetherstonhaugh No. 2, 6875 feet.

In 1924 the following camera stations were occupied: Casket Mountain, 7320 feet; Casket Pass, 7027 feet; Butterfly, 7665 feet; Sheep Creek S., 7500 feet; Intersection Mountain No. 1, 8075 feet; Intersection S. No. 1, 7557 feet; Intersection S. No. 2, 7425 feet; Sheep Pass S., 7474 feet; Ewan, 7230 feet; Casket N., 7043 feet.

SHEEP PASS

The continental watershed crosses Sheep Pass summit in a north and south direction, very nearly two miles west of the 120th meridian, near the Inter-provincial Boundary. The altitude of the summit is 5372 feet above sea level. Close to it on the east side is a group of four small lakes, and farther away to the northeast two others which, with their sources of supply, form the headwaters

of Sheep Creek, flowing eastward across the 120th meridian into the Province of Alberta. On the western side of the watershed the sources of Bastille Creek have their rise.

Some seven and a half miles from the summit of the pass Sheep Creek is joined on the south by Casket Creek, flowing from Casket Pass. A few miles farther on, the north branch joins the main stream.



VALLEY OF SHEEP CREEK, LOOKING EAST
Wide Amphitheatre North of Sheep Pass—Summit in Foreground

The valley of Bastille Creek is densely forested, beginning at the very summit of the pass, and shows few and insignificant open spaces, which vanish entirely a few miles down stream. On the other hand, the valley bottom of Sheep Creek is open meadowland almost to the summit of the pass. This open strip extends down stream for some six miles and the creek, which has not yet gathered much volume, flows in the midst of the open in sinuous loops. On either side forest growth clothes the slopes for 600 to 700 feet of elevation, and then scattered scrub extends to timber line. Advantage of this open and comparatively level valley bottom was taken by the Geodetic Survey triangulation party to measure a base line, referred to at greater length farther on.

At the head of the valley, directly north of the summit of the pass, is a broad amphitheatre reaching northward for approximately three miles and having about the same width. Three prominent elevations rise above its

margin, viz.: Mt. Buchanan, 8973 feet in altitude, on the west, Wallbridge Mtn., 8086 feet in altitude on the north and Bastille Mountain, 8120 feet in altitude, on the east. The floor lies at an altitude from 100 to 200 feet higher than Sheep Creek valley bottom and is open meadowland interspersed with groves and clumps of small spruce and balsam on the highest elevations.

Across this area the watershed lies, but it is difficult to say just where without a definite survey and a series of cross section levels. There is no direct flow of considerable volume from the amphitheatre, and the drainage to it, which is considerable, seems to run off in sub-surface flow by means of natural potholes, which are seen at various places. Beyond the more level bottomland, steep grassy slopes and, higher up, limestone shales lead to the rim of the basin.

Leaving the pass summit, the watershed lies on an uneven course, a little east of north in general direction for four and a quarter miles to the summit of Bastille Mountain. It then swings northeast on a fairly straight course for two and three-quarters miles to the summit of Wallbridge Mtn. Thence, the course has a general north direction for three and three-quarters miles to the summit of a pass of the Great Divide leading from Cecilia Lake to Broadview Lake, a mile east of the summit of Kakwa Pass.

The Bastille-Wallbridge ridge shows steep shale slopes on the southwest side and a precipitous rock face on the northeast side, the latter supporting a cliff glacier, two miles in length. The ridge divides the waters flowing to Sheep Creek and to Cecilia Lake on the east side from those flowing to Bastille Creek and to an unnamed stream tributary to the Fraser on the west side.

CECILIA LAKE

The lake is a very beautiful one, of a rich deep blue colour, some two miles in length by half a mile wide. Situated in a pocket of the surrounding heights, it is so closely encircled that it is very nearly reached before being seen. In consequence it is known locally as "Surprise" Lake. The name, Cecilia Lake, was given by Mr. Lambart and as there are a number of other Surprise Lakes, it has been adopted.

The upper valley of the lake is fairly open with scattered bodies of spruce and balsam of small size. The slopes encircling the basin of the lake are densely forested. The outlet, Cecilia Creek, flows in a broad valley showing much open meadowland along the bottom and densely forested side slopes. It has a northwesterly course of some nine miles to its junction with the Kakwa River. The 120th meridian passes within an eighth of a mile of the most northerly extremity of the lake.

Near the south end a pass over the watershed leads northwesterly to the valley of an unnamed stream on the westerly side which is tributary to Fraser River. It lies between Wallbridge and Broadview Mtns., and has a summit altitude of about 5600 feet. It is suitable for travel with horses as the valley is sparsely timbered and is open going all the way. It was the route travelled by the survey party.

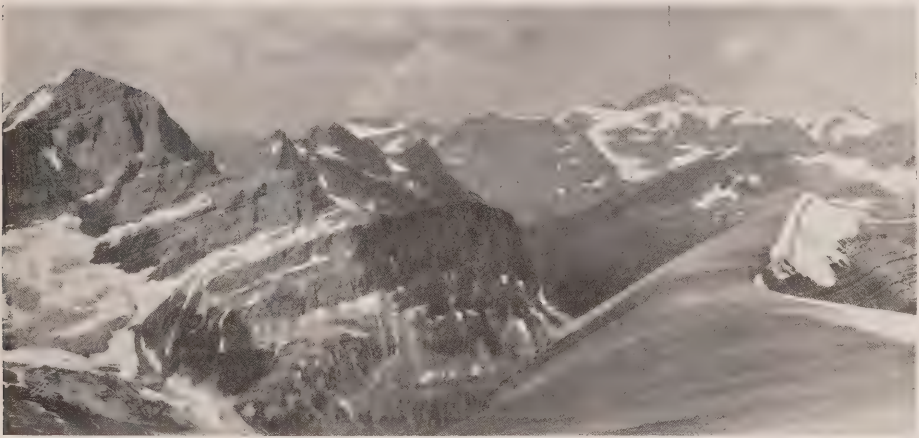
CÔTÉ CREEK

East of the Bastille-Wallbridge ridge is a lower ridge, separating the upper valley of Cecilia Lake from the valley of Côté Creek. Mt. Côté, 7844 feet in altitude, dominates this ridge and the 120th meridian passes over the peak quite close to its summit. Mr. Cautley's boundary monument 56-3 is situated between 300 and 400 feet northeast of the Geodetic Survey's triangulation station on the summit of the peak.

The valley of Côté Creek is broad and well forested, showing much open meadowland along the bed of the stream and the beds of the many streams tributary to it. The valley trends northwest, and a low pass at its head gives access to the valley of Cecilia Lake. Northeastward across the ridge of hills bounding the valley of Côté Creek rise the headwaters of Copton Creek.

Mt. Buchanan

Mt. Sir Alexander



MT. SIR ALEXANDER AND MT. BUCHANAN

KAKWA PASS AND LAKE

From the summit of the pass northwest of Cecilia Lake the watershed passes over the summit of Broadview Mtn., and curves northwesterly for three and a half miles, when it turns at right angles and doubles back southwesterly for some five miles, crossing the summit of Kakwa Pass midway in its course, at an altitude of 5165 feet above sea level. It then describes a wide curve to the west and on an erratic northward course crosses the valley of Jarvis Pass, and so on northwesterly.

North of Kakwa Pass summit the drainage flows to Kakwa Lake, some three miles distant. It is a fine sheet of water, three miles long and three-quarters of a mile at its greatest width, lying at an altitude of 4810 feet and bordered by more or less open forest. Wapumun Lake, connected by a narrow channel a quarter of a mile long, lies directly south of it, and another of larger size a mile or so to the west.

On the south side of the pass the drainage flows southward some nine or ten miles and then westward along the south base of Mt. Sir Alexander to a junction either with the stream flowing westward from Jarvis Pass or with Bastille Creek flowing from Sheep Creek Pass; which stream it joins was not ascertained.

Kakwa Valley, at its head, is a broad open one with scattered bodies of spruce, becoming more densely timbered as Kakwa Lake is approached. Beyond it, north of the lake the valley widens to several miles and becomes still more densely timbered. The stream from the lake is of small proportions for the first four miles of its course. It is then joined by Cecilia Creek and thereafter becomes a swiftly flowing river. Some two and a half miles beyond the junction Jarvis Creek, a strong flowing stream comes in from Jarvis Pass, which very

S. Branch Big Salmon River

Summit of Pass

Kakwa Lake

Mt. Jarvis



KAKWA PASS AND LAKE

appreciably increases the volume of the Kakwa. About two and a half miles farther on, the river is crossed by the boundary line between the two provinces, the 120th meridian of west longitude. At this point the valley floor is some two miles wide.

JARVIS PASS

Jarvis Pass crossing of the watershed lies in a narrow, deep valley, cutting through the centre of the last high group of mountains, of which Mt. Sir Alexander 10,740 feet and Mt. Ida, 10,472 feet in altitude, are the dominating peaks. Mt. Ida rises directly south of the pass, on the west side of the watershed. It is an outstanding peak of handsome proportions and carries several small glaciers on its basal cliffs. Mt. Sir Alexander is the major peak of the group, and is a landmark for the locality, owing to its greatest altitude and the striking form of its summit mass. It rises, a sharply defined wedge of rock from icefields that surround it and which rest upon a base showing massive perpendicular

cliffs, giving rise to several broken icefalls which in turn form the headwaters of a fairly large unnamed stream tributary to the Fraser. This summit wedge is symmetrical in form and is so sharp at the crest that there does not appear to be even standing room. The mountain, although attempted by Donald Phillips and Miss Mary Jobe in 1914 still remains a virgin peak awaiting and defying conquest.

Jarvis Pass is distinctive, owing to the number of small lakes on its summit, some six or more in number, which are distributed on both sides of the watershed. The pass is densely timbered and the waters from the lakes flow westward to an unnamed tributary of Fraser River and eastward to the Kakwa.

Mt. Sir Alexander

Mt. Ida



KAKWA LAKE AND PASS

KAKWA RIVER VALLEY

Beyond the Jarvis Pass tributary the valley broadens out considerably and has a width of from four to five miles between its steep bounding slopes. It is fairly well timbered with spruce and pine in bunches of considerable size and also shows numerous patches of open meadowland, separating the timber into units. Much burned over area is seen, on the north side of the river and on the northern slopes of the valley.

The north bounding ridge of the valley is the height of land between Kakwa River on the south and Narraway and Torrens Rivers on the north, and in consequence the streams flowing southward to the Kakwa have only short courses. The Kakwa is here a broad stream winding through the more heavily timbered portion of the valley in sinuous loops. From the junction of the Jarvis Creek it winds eastward in this wide valley for some eight miles of direct distance, when the valley narrows and the stream flows in a more restricted trench, which soon assumes a canyon-like appearance through the foothills to the plateau country beyond.

Within the area embraced by the survey, there are three distinct passages to the Narraway and Torrens Rivers drainage basins, all of which are open to travel with horses, viz: (1) Hanington Pass to the headwaters of Hanington Creek, a tributary of Narraway River; (2) the pass directly southwest of Mt. Gorman to the head of Gorman Creek, the one travelled by the survey party; (3) the pass northeast of Coal Ridge camera station to the headwaters of the south branch of Torrens River. As stated, the summits of all three passes lie only a short distance north of the Kakwa Valley.

South of the river the 120th meridian passes about 800 feet west of Kakwa Camera station, and north of it about 400 feet east of the summit of Mt. Gorman. The width of the Kakwa Valley, from rim to rim, is here about six miles.

Mt. Ida

Mt. Jarvis



KAKWA LAKE AND PASS

To cover the country between Sheep Pass and the Kakwa Valley the following camera stations were occupied: Blair, 7671 feet; Blair Shoulder, 7403 feet; Cecilia W. No. 1, 7484 feet; Cecilia W. No. 2, 7323 feet; Broadview Mtn. 8059 feet; Mt. Ruth 8305 feet; Cecilia N., 7122 feet; Departure Peak, 7519 feet; Wallbridge Mtn., No. 1, 8317 feet; Wallbridge Mtn. No. 2, 8086 feet; La Crèche Mtn., 7641 feet; Crèche Shoulder, 6993 feet; Kakwa Mtn., 7531 feet; Promenade, 7958 feet; Omye, 7846 feet; Copton, 7757 feet; Mt. May (George Pk.), 8038 feet; Mt. May (Francis Pk.), 8019 feet; Cheval Hill, 6571 feet; Cockle, 7490 feet; Bastille Mountain, 8120 feet; Mt. Côté, 7844 feet; Sheep Pass N., 7422 feet; Sheep Creek, 6847 feet.

NORTH OF KAKWA VALLEY

Nearly eight miles north of Mt. Gorman lies Mt. Torrens. The 120th meridian passes about 1800 feet west of the summit. It was to this point Mr. Cautley carried the meridian southward in 1922, and from it to Intersection

Mountain in 1924, thereby closing the survey of the boundary as far as made by the Interprovincial Boundary Commission.

Three and a half miles north of Mt. Torrens the meridian crosses Narraway River. Thirty-one miles farther north it crosses Wapiti River, and immediately from the south bank of this stream the foothills of the main range of the Rockies begin to rise, rising 2200 feet in less than a mile, as shown by Mr. Cautley's map accompanying his report for the year 1922.

The area between the Kakwa Valley and Mt. Torrens is composed of elevations ranging in altitude from 5700 feet to 7900 feet above sea level. The hills here lose their bold, individual character and become more rounded and uniform in shape. Their surfaces are largely composed of easy slopes of broken

Mt. Jarvis

Mt. Ida

Jarvis Pass Summit



KAKWA VALLEY AND JARVIS PASS

shale, and the valleys between the several ridges are narrower and more densely timbered.

Two main streams drain the area mapped by the survey, viz.: Narraway River, north of Mt. Torrens and Torrens River, south of it. Both have a general easterly course and flow to the Wapiti, Torrens River being a tributary of the Narraway. Hanington Creek, Saxon Creek and Dinosaur Creek flow northward to the Narraway, and Gorman Creek and the south branch of Torrens River flow north to Torrens River. The valley of Torrens River is connected with that of Hanington Creek by a low pass, some 5200 feet in altitude, and with the valley of Saxon Creek by a pass, some 4800 feet in altitude; both are suitable for travel with horses from one valley to the other. In fact pack-horses can be taken in almost any direction it may be desired to go.

To cover the country north of Kakwa River the following camera stations were occupied: Mt. Minnes, 7946 feet; "J," 6935 feet; Mt. Gorman No. 1, 7800 feet; Gorman No. 2, 6466 feet; Hanington Pass N., 7048 feet; Coal Ridge,

6922 feet; Hanington E. ("K"), 7435 feet; "F," 6912 feet; "F" Shoulder, 6921 feet; Torrens Overlook No. 1, 7416 feet; Torrens Overlook No. 2, 6698 feet; "C," 7089 feet; Good Luck No. 1, 7811 feet; Good Luck No. 2, 6998 feet; Herd, 7154 feet; Herd Shoulder, 6853 feet; Huwino, 7052 feet; "G" West, 6905 feet; "G" East, 6981 feet; Horn Ridge, 7002 feet; Torrens S.E., 7182 feet; Torrens Cone, 7167 feet; Torrens Shoulder, 5709 feet; Base Line N., 6376 feet; Torrens Ridge, 6951 feet.



KAKWA RIVER AND VALLEY

From Mt. Torrens Mr. Cautley produced the 120th meridian southward to the intersection with the watershed and his report of his 1924 surveys deals in detail with the various topographical features encountered, and with the monuments erected to mark the meridian, (See Chapter III-B, "Field Work, Season of 1924" and also Chapter IV-B, "Description of Country by Townships."

GENERAL REMARKS

Watershed.—The general direction of the watershed has been given above under the headings of the several passes and other topographical features. South of its intersection with the 120th meridian it is the boundary between the two provinces and is of primary importance. The intersection takes place almost at the summit of Intersection Mountain on the south side of Sheep

Creek valley, at Mr. Cautley's boundary monument 56-0, altitude 8044 feet. North of that point the 120th meridian becomes the boundary and the watershed diverges on a general northwest course, following the highest summits of the range. It has been described as far as Jarvis Pass, where it ceases to be of interest from a provincial boundary point of view.

Trails.—The trails leading from the Jasper, Mt. Robson and McBride centres to the country north of Mt. Robson are described in Chapter II-A under General Remarks. As there stated, the main trail of travel northward passes over the Great Shale Hill, on the north side of Pauline Creek. Beyond this ridge, the south ascent of which is very arduous owing to mud-holes and brûlé, travel becomes easy for horses except for the constant ascent and descent of

Mt. Torrens



MT. TORRENS AND VALLEY OF SAXON CREEK

big hills. Owing to the open nature of the country horses can be taken in almost any direction through the valley bottoms and over the intervening divides, a fact which greatly facilitated the work of the survey and was distinctly a contrast to the difficulties encountered south of the Big Shale Ridge.

Leaving the ridge the main travelled trail crosses Morkill Pass, 5434 feet, Fetherstonhaugh Pass, 5924 feet, Forgetmenot Pass, 5899 feet, Casket Pass, 5386 feet, Casket Creek valley, Sheep Creek valley, between Bastille Mountain and Mt. Côte, the upper valley of Cecilia Lake, a pass northwest of Cecilia Lake 5600 feet, Kakwa Pass, 5165 feet, and so to Jarvis Pass. The route followed by the survey party continued along the west side of Cecilia Lake and down the valley of Cecilia Creek for some three miles, when it crossed the 120th meridian, recrossing it two miles farther on, and then over Cheval Hill to the valley of Kakwa River. North of the river the trail crossed and recrossed the 120th meridian within a mile north of monument 59-2, 4849 feet. It then crossed the ridge to Gorman Creek and down that valley to Torrens River, which it followed

to the junction with Saxon Creek and down the valley of the same to Narraway River. The travelling throughout the area described is generally good and nearly all the adjacent valleys can be reached by means of low divides.

Rivers and Streams.—The principal streams encountered are Sheep Creek, and Côte Creek, both of small size until below the junction; Cecilia Creek and Jarvis Creek, tributary to Kakwa River which, below their junction, becomes a broad rapid river; Gorman Creek and south branch of Torrens River, both tributary to Torrens River; Hanington Creek, Saxon Creek and Dinosaur Creek, all tributary to Narraway River.

All the streams named were encountered too near their sources to offer any great obstacle to travel at the time of the survey, although Mr. Campbell's party when camped near Mt. Torrens was flooded out and had to move camp



MT. TORRENS AFTER A SNOWSTORM, LOOKING NORTHWEST

quickly to avoid disaster. The sudden flooding of the stream was likely due to a cloudburst in the surrounding mountains.

Timber.—Timber line here is at 6200 feet, or a little over. The general species along the watershed are spruce, balsam and, lower down on the east side, pine. The only commercial value of the pine would be for ties, telegraph and telephone poles and for fence posts. It could be used for small lumber for local purposes, but no stands of timber of dimensions worth real lumbering operations were seen.

On the west side of the watershed the forest growth is much thicker and apparently the timber dimensions are larger. Wide tracts of old brûlé were noticed particularly on Sheep Creek east of the meadowlands and in Kakwa Valley; also in the vicinity of Mt. Torrens and at a few other places but, taken as a whole, the proportion is small.

Game and Fish.—The open hillsides and meadowland valleys of the area adjacent to Sheep Creek are a paradise for big game hunters. Caribou and

smaller deer are plentiful, and moose are seen quite frequently. Brown bear are in the woods, for though none were seen, their presence was indicated by the turned over logs and broken dry stumps, where they had been searching for ants and grubs. Grizzlies frequent the rocky cirques and passes near or above timber line, where the Parry marmots (mountain gophers so-called) live in colonies on the patches of alpine meadowland and afford them good hunting. In these places one can see deep excavations where the bears have attempted to dig out the gophers. Observing the huge stones that have been removed in this process of excavation, one wonders whether the moth is worth the candle; and, judging by the rapid and elusive movements of the marmots, and also the fact that there seem to be many back doors to their residences, whether the



SHALE HILLS, SHOWING FORMATION

grizzly is often successful. Mountain goat are frequently seen on the rock faces of the mountain, and a little farther east, among the lower shale hills in the Sheep Creek and Kakwa River country, the Big Horn or mountain sheep are abundant.

Many hunting parties visit this section of the country during the late fall, when the hunting season is open, and generally go away well satisfied with the sport they have had. The dry, grassy meadowlands, interspersed with groves of trees, furnish ideal hunting conditions and most attractive camping grounds, making the terrors of the trail well worth while. Ptarmigan are seen on the rocky slopes above timber line and also the blue grouse. In the woods there are several other species of lower habitat.

No fish were caught by the survey party. Although trout are said to inhabit the streams lower down, they do not seem to frequent the upper waters so near the source in sufficient quantity to make it apparent.

MAPS

Map Sheets 37, 38, 39 and 40 have been completed from information obtained from the season's surveys. Additional information has been added to sheets 30 and 32 and unmapped areas filled in; in both sheets the position of the watershed has been laid down from information furnished by Mr. Cautley's detailed surveys of the Robson and Miette Passes.

In all sixty-one main camera stations were occupied and twenty-three sub-stations. Five hundred and two views were taken in the field and an area of 550 odd square miles mapped for the sheets of the Interprovincial boundary survey. The area covered by the photo-topographic survey is considerably greater, but much of it falls without the limits of the map sheets.



SHOWING PLATEAU LANDS NORTH OF THE MOUNTAINS

ROBSON PASS

Robson Pass is fully described in Chapter I-A dealing with the surveys of the Topographical division in 1922. It was then doubtful just where the watershed lay as no detailed survey had been made. Mr. Cautley's survey of 1924 definitely established the position of the watershed and he erected concrete monuments to mark the boundary. The report of his survey is as follows:

"After completing the survey of the 120th meridian to its intersection with the summit of the Rocky Mountains, Mr. Cautley's division proceeded to Robson Pass by the Shale Hill, Jackpine Valley and Bess Pass trail, which is about 75 miles from Sheep Creek to Robson Pass. The party arrived at Robson summit on the 25th August, where Mr. Wheeler was awaiting them.

The summit of Robson Pass is a broad gravel flat extending between Adolphus Lake on the Alberta side and Berg Lake in British Columbia, the two lakes lying about a mile apart.

In no other pass of the Rockies does one mountain so dominate the entire landscape as does Mt. Robson. Its enormous mass (altitude 12,972) towers 7532 feet above the summit of the pass at such close range as to literally overshadow it. Together with Robson Glacier, curling around its easterly face, Mt. Robson completely fills the range of the eye's vision. It constitutes a picture of such unique character that it will probably become world-famous among artists as an outstanding example of a tremendous, solitary, self-contained subject in black and white, in the boldest style imaginable.

Boundary Line.—The characteristic letter of the Robson Pass survey is "U".

Monument 1-U is built nearly in the centre of the gravel flat. By direction of the Governments, Monument 1-U is in the nature of a memorial monument commemorating the conclusion of the Interprovincial Boundary Survey. It was erected under the supervision of Mr. A. O. Wheeler and bears brass plates with the names of the Commissioners on the westerly face and a tribute to the late Dr. Deville, under whose direction the work was organized, on the easterly face. Although referred to as Monument No. 1-U, as being a monument of the survey, it is not so marked.

Two concrete monuments and two bolt and cairn monuments were established north of Monument 1-U. Monument 2-U is at the northerly edge of the gravel flat. Monument 4-U is 1100 feet above the flat on the slopes of Mumm Peak. Bolt and cairn 4 A-U is 2900 feet above the flat, and Bolt and Cairn 6-U is at the summit of Mumm Peak (altitude 9718) and marks the northerly extremity of the straight-line boundary in Robson Pass.

One concrete monument and one bolt and cairn monument were established south of Monument 1-U. Concrete monument 3-U is built on a bedrock ledge which cuts off the flow from Robson Glacier and diverts it to British Columbia. Bolt and Cairn 5-U is the southerly extremity of the straight-line boundary and is situated on the brink of a rock escarpment which forms the northerly edge of the long slope leading up to Titkana Ridge.

The total length of the straight-line boundary surveyed in Robson Pass is 253,220 chains.

The survey was completed on the 5th September, 1924."

MIETTE PASS

For description of Miette Pass see Chapter I-A covering surveys by the Topographical division in 1922. Mr. Cautley's report of his survey of 1924 to establish the boundary across the pass is as follows:—

"Mr. Cautley's party arrived in Miette Pass on the 10th September, having spent five days covering some 35 miles by the Calumet Creek, Moose Pass, Colonel Pass and Grant Pass trail, owing to loss of time on account of bad weather.

Miette Pass is a gap of about three miles between high mountains of the main divide, in which there are three distinct passages separated by two ridges

about 1100 feet above the centre pass. The centre pass is 6450 feet in altitude. The south pass is 6950 and the north pass is 7174.

The centre pass is thinly timbered but the other two, being practically above timber line, are open. All three passes drain to Miette River on the Alberta side and to Grant Brook on the British Columbia side.

Boundary Line.—The characteristic letter of Miette Pass survey is "T".

Monument 1-T is a concrete monument right on the true summit of the centre Pass.

North of Monument 1-T there are three concrete monuments—Nos. 2-T, 4-T and 6-T, and one bolt and cairn monument—No. 8-T. Monument 2-T is on the northerly edge of the centre Pass valley. Monument 4-T is on the summit of the ridge between the centre and the north Passes. Monument 6-T is on the summit of the north Pass. Bolt and Cairn 8-T is on a bold, rocky point on the watershed and marks the northerly extremity of straight line boundary in Miette Pass.

South from Monument 1-T there are four concrete monuments—Nos. 3-T, 5-T, 7-T and 11-T, and one bolt and cairn monument, No. 9-T. Monuments 3-T and 5-T mark the Boundary across the lower valley of the centre Pass. Monuments 7-T and 9-T are on the 1100 foot ridge between the centre and the south Passes. Monument 11-T is on the true summit of the south pass and marks the southerly extremity of straight-line boundary in Miette Pass.

The total length of straight-line boundary surveyed in Miette Pass is 386.709 chains.

The work in Miette Pass was greatly delayed by bad weather. It snowed every day from the 18th to the 26th September inclusive, on which latter date there was twenty-one inches of wet, heavy snow on the floor of the valley, and from three to four feet on the hillsides above timber line, over which the survey had to be carried. It also snowed on the 30th September and on the 1st and 3rd October. Most of the time the temperature was below freezing, and there were high winds. Under the circumstances it became necessary to adopt arduous methods; horse trails had to be shovelled out up to the higher monument sites; dry wood, and tubs in which to melt snow, had to be packed up the mountains together with the usual loads of cement, gravel, forms, etc.; concrete had to be made with hot water so as to overcome the frozen condition of the gravel, and hot rocks laid under canvas around the green concrete so as to permit it to set. When the time came to remove the wooden forms, and bring them back, the snow was so deep it was impossible to use the horses at all and the men had to pack them back. Angles read at exposed stations above timber line under such weather conditions are naturally subject to suspicion, but Mr. Cautley and his assistant, Mr. Gorman, were very much relieved to find that their triangles closed within perfectly normal limits.

Mr. Wheeler and party arrived at the Miette Pass Camp on the 25th September, in the midst of a wild snow storm, having been storm-bound for

three days at Colonel Pass—only five miles away—and the Commissioners went over the work together on the following day.

The work was finished at Monument 11-T on the 3rd October, 1924, under winter conditions, and the party reached Jasper on the 6th and were paid off. Mr. Cautley remained at Jasper for a few days in order to dispose of the Commission's horses, most of which had been used on the Boundary survey for five years, and arrived in Edmonton on the 11th October."

MEMORIAL MONUMENT

It was decided that a special memorial monument of the boundary survey should be erected at the summit of Robson Pass. The Alpine Club of Canada was holding its annual camp there, so it was arranged to have the unveiling ceremony take place on the morning of July 31st while the camp was in session, and to hold the annual meeting of the club the same afternoon.

This arrangement was a most appropriate one, for the work of the boundary survey has been of very special interest and benefit to the club and to its widely scattered members, owing to the fact that the watershed of the main range of the Rockies, which constitutes the boundary between the two provinces, lies along the crests of the highest peaks of the range, and that the mapping of these areas and consequent distribution of information concerning them has been of very great value to all visitors, or prospective visitors, to the Canadian Rockies. So much so has this been the case that map distribution in connection with the boundary survey has very greatly surpassed the original expectation, and many of the sheets illustrating the more attractive parts have gone through several editions, owing to the demand for them, and have proved of great advertising value to the tourist business of the mountain regions quite apart from the survey of the boundary.

At the unveiling ceremony the Government of British Columbia was represented by Mr. G. R. Naden, Deputy Minister of Lands, and Mr. J. E. Umbach, Surveyor General of British Columbia; the Government of Alberta by Mr. P. N. Johnson, Director of Surveys; the Dominion Government by Mr. J. N. Wallace, Boundary Commissioner during the first two years of the survey, and by Mr. F. H. H. Williamson, Deputy Commissioner of the National Parks Branch of the Department of the Interior; the Geodetic Survey of Canada, by Mr. H. F. Lambart, in charge of the parties of the Geodetic Survey collaborating with the boundary survey; the Canadian National Railways by Mr. Osborne Scott, General Passenger Agent; and the Canadian Pacific Railway by Mr. A. O. Seymour, General Tourist Agent.

Unfortunately Mr. R. W. Cautley, Interprovincial Boundary Commissioner, representing the Dominion Government and the Government of Alberta, was at the time working upon the boundary in wild country far to the north and it was not possible to get word to him in time to attend the ceremony, but Mr. A. J. Campbell, D.L.S., who had been associated with Mr. Wheeler's division of the survey as chief assistant in charge of the photo-topographic work since the

beginning, arrived the same day. The monument was unveiled by Mrs. Campbell as a tribute to the excellent work done by her husband in the survey of the Boundary.

The erection of the monument lay within the province of Mr. Cautley's division but, owing to his forced absence, the work was done under Mr. Wheeler's superintendence, with the very efficient assistance of Mr. Lambart and Mr. A. H. MacCarthy, the latter a member of the Alpine Club, who had had practical engineering experience as a commander in the United States navy.



MEMORIAL MONUMENT ERECTED IN ROBSON PASS

The ceremony was an impressive one. The towering magnificence of the mighty snow-clad mass of Mt. Robson, rising directly above, gave solemnity and dignity to the scene. The surroundings were certainly unique; the great mountain whose crest, golden in the fitful sunshine and then obscured by passing clouds, was a full mile above us, close by the glorious blue waters of Berg and Adolphus Lakes, and all around wide-spreading snow-fields and tumbling

icefalls between precipitous rock ramparts, the crowd of picturesquely garbed mountain climbers, men and women, assembled about the monument, which occupied the centre of a broad, bare shingle flat, brought vividly home to us the magnitude of the works of nature at their origin and the wonderful heritage we possess in this mountain wilderness of unsurpassed scenic grandeur.

Mr. Naden opened the proceedings with a few appropriate remarks followed by the Surveyor General of British Columbia, who complimented the Commissioners upon the successful completion of a distinctly arduous undertaking. Acknowledgments were made by Mr. Wallace and Mr. Wheeler. Then, as the Union Jack fluttered from the unveiled monument, the cook's tocsin sounded at the Alpine Club camp and a passing rain-storm scattered the assemblage to well-earned refreshments after its labours.

The monument erected did more than memorialise the boundary survey; On the Alberta side an inscription plate recorded the name of the late Dr. Edouard Deville, I.S.O., LL.D., D.T.S., F.R.S.C., who for more than forty years had been Surveyor General of Canada, and under whose direction the work of the boundary survey had been carried on since its inception in 1913. A man and a scientist, to whom Canada owes most largely her magnificent system of land surveys, and also the introduction of the method of photo-topography, a method so well suited to her mountain areas and so successfully carried on in mapping them. It is fitting that his name should be on record at a place where their grandeur reaches a climax.

Part III-B

SURVEY OF 120th MERIDIAN

1918, 1919, 1920,
1922, 1923, 1924.

CHAPTER I

THE MERIDIAN SECTION OF THE BOUNDARY

The Boundary between the Provinces of Alberta and British Columbia is defined by Sections 7 and 8 of the Imperial Act, 29 and 30 Victoria, Chapter 67, which are as follows:

"7. Until the Union, British Columbia shall comprise all such territories, within the Dominion of Her Majesty, as are bounded to the south by the territories of the United States of America, to the west by the Pacific Ocean and the frontier of the Russian territories in North America, to the north by the Sixtieth Parallel of North Latitude, and to the east from the Boundary of the United States northwards by the Rocky Mountains and the one hundred and twentieth Meridian of West Longitude; and shall include Queen Charlotte's Islands and all other Islands adjacent to the said Territories, except Vancouver Island and the islands adjacent thereto."

"8. After the Union, British Columbia shall comprise all the Territories and Islands aforesaid and Vancouver Island and the islands adjacent thereto."

In the report of the Minister of the Interior to His Royal Highness in Council, which was approved on the 18th day of February, 1913, is embodied the following interpretation of the above definition, which interpretation was drawn by the Surveyor General of Dominion Lands and concurred in by the several Governments concerned:

"Between the International Boundary and the 120th degree of longitude, the Interprovincial Boundary is the line dividing the waters flowing into the Pacific ocean from those flowing elsewhere. This line may cross several times the meridian of 120° longitude. Should this be the case, it is proposed that the Interprovincial Boundary follow the watershed line from the International Boundary to the most northerly crossing of the meridian and thence follow the meridian to the 60th degree of latitude. The watershed line being a natural feature is preferable to the meridian as a boundary and there are as many chances that the proposal, if agreed to, shall be in favour of one Province as of the other."

The foregoing sections of the Imperial Act and the interpretation thereof adopted by the several Governments concerned will be found in Part I, Chapter I of the Report of the Commission, published in 1917, and are merely reproduced here in order to establish the legal status of that part of the Interprovincial Boundary which follows the 120th meridian.

It will be noted that the interpretation of the Imperial Act whereby "the most northerly crossing of the meridian" is agreed upon as the point at which the Boundary ceases to follow the summit of the Rocky Mountains, but follows the 120th meridian, has no bearing on the survey, since the expectation that the 120th meridian might cross the summit more than once was not fulfilled.

NECESSITY FOR SURVEY OF 120TH MERIDIAN

When the Commission was first appointed, the Governments concerned were more immediately interested in the delimitation of the Boundary through the passes in the mountain section, rather than where it follows the 120th meridian.

One reason was that the development of the coal industry had reached a point where it was definitely known that enormously valuable deposits of coal extended right across the Boundary.

Again, it was realized that while the summit of the Rocky Mountains, established by law as the Boundary, constituted one of the world's most stupendous interprovincial barriers, there was very little scientific information as to its exact location. In the railway passes and at a few other points the position of the summit had been established, but for hundreds of miles the backbone of the Continent was shown on existing maps as a dotted line whose curves have in some cases been shown by the Commission's work to be more graceful than accurate.

Still a third reason may be found in the Government's growing interest in the development of the National Parks system, and the encouragement of tourist traffic. Until very recently the people of Canada have, on the whole, been inclined to view our wonderful parks without much enthusiasm; as a long-term investment which might possibly be valuable some day in the future as the only possible use to which some millions of acres of mountainous country could be put, in view of their otherwise useless character; in fact the National Parks have been regarded as an ornate but unproductive background for the wide prairies with their more obvious wealth of natural resources.

Of late years public opinion has shown a much greater interest in the potentialities of our National Parks. Not only has it been borne in upon Canadians—generally by visitors from outside Canada—that our Parks are a world-wide wonder from a scenic point of view, but many of our leading men realize that they are, even now, a valuable material asset.

The work of the Commission has done much to stimulate interest in the Parks and to aid in their physical development. The majestic peaks of the great chain which forms the summit of the Rocky Mountains have, for the first time, been accurately surveyed. Survey monuments have been established on which future surveys will be based. Routes of travel have been explored and reported on. Most important of all, the maps which accompany the Commission's Report constitute a permanent record for all time of some of the most difficult, as well as most interesting, parts of the mountain region. These maps have been chiefly prepared from the photo-topographical work of Mr. Wheeler's division, and have been of the greatest interest to many sections of the public, as the constant demand for them proves.

In the year 1917, however, the survey of that part of the Boundary which follows the 120th meridian assumed importance in the eyes of the Governments, and it was agreed that the work should be undertaken by the Commission in 1918.

The urgent necessity for the survey of the 120th meridian arose from a number of more or less distinct considerations. In the first place the valuable character of the land adjoining the 120th meridian on the south side of Peace river attracted a large number of settlers to what is known as Pouce-Coupé district. The greater part of this settlement is within the boundaries of Peace River Block¹, which is subdivided as a normal extension of the Dominion Lands System. But there were a number of settlers who desired to take up land adjoining the 120th meridian in British Columbia territory. In order to deal with such applications a provisional boundary line had been run by the British Columbia Government, which, however, from connections made to it on the Dominion Lands System of Base Lines, was thought to be about a quarter of a mile too far west.

In the second place, both the Dominion Government and that of British Columbia desired to extend their subdivision surveys up to the Boundary—from east and west respectively—during the season of 1920.

In the third place, it was very necessary that the 120th meridian should be run south to its intersection with the summit of the Rocky Mountains, in order to determine the point at which the Boundary ceased to follow the summit.

Finally it was desired to establish the Boundary across Peace river—that most noble artery of Northland traffic—and the unsurveyed country to the north of it, with a view to the proper administration by the adjoining Provinces of their respective laws.

APPORTIONMENT OF WORK BETWEEN COMMISSIONERS

From the inception of the Interprovincial Boundary survey in 1913 until the end of 1917, the Commissioners had worked in more or less close conjunction. There are a number of important passes to the south of Kicking Horse Pass, the survey of which made it necessary for the Commissioners to meet frequently. At the end of 1917, however, Mr. Cautley's division had surveyed Howse and Yellowhead Passes, while Mr. Wheeler's division was just entering on a long stretch of the wildest and most inaccessible part of the main range, extending northward from Howse Pass, in which—as far as was then known—there were only four major passes, none of which could be reached by Mr. Wheeler's division for two full seasons.

When, therefore, the Commissioners were informed that the survey of the 120th meridian should be commenced in 1918, it was decided on their recommendation that Mr. Cautley should undertake the survey of the 120th meridian while Mr. Wheeler continued the photo-topographical survey of the Boundary along the summit of the Mountains.

As the work developed the result of the above arrangement was that Mr. Cautley was engaged on the survey of the 120th meridian during the seasons

¹ Peace River Block comprises 3,500,000 acres of land granted to the Dominion Government by the British Columbia Government in lieu of lands alienated by the British Columbia Government in the 20-mile railway belt along the Canadian Pacific Railway. British Columbia retains the right of administration within the Block, and also title to gold and silver. Land, oil, coal and all non-precious minerals are vested in the Dominion Government. Along the 120th meridian, the Block extends from the north boundary of township 76 to the north boundary of township 88.

of 1918, 1919, 1920, 1922, 1923, and a portion of 1924. In 1921 the Commissioners joined forces again in the mountains, in order to complete that section of the Boundary lying between Kicking Horse and Yellowhead Passes which is covered by Part II of the Commission's Report. An account of the work done in 1921, and of the four passes surveyed during that year, will be found in Part II of the Report.

In 1924 the Commissioners again worked together; first in the survey of the southerly 34 miles of the 120th meridian from its most northerly intersection with the summit of the Rocky Mountains to the point on Mt. Torrens at which the survey had been discontinued in 1922; secondly in the survey of Robson and Miette Passes.

An account of that part of the 1924 season spent on the survey of the 120th meridian will be found in Chapter III of Part III B of the Report, while the survey of the passes is dealt with in Part III A.

ESTABLISHMENT OF LONGITUDE PIER AT POUCE-COUPÉ

Before it was possible to proceed with the survey of the 120th Meridian it was essential that some point of known longitude should be established in close proximity to it.

The longitude of any desired point may be derived from the known longitude of some other point by the simple process of adding to the known longitude the difference in sidereal time, expressed in terms of arc, which is found to exist between the two points. No problem could be more simple in theory. In practice, however, it involves the necessity of being able to compare the times of two far-distant places at the same instant of time, if any degree of precision is to be obtained. Such an instantaneous comparison of times could only be made by telegraphic methods, so that in the past it was not considered possible to make a precise determination of longitude by observation at any point that was not connected by telegraph line with some point of previously determined longitude.

Now-a-days excellent results in longitude determinations are being obtained by the use of radio telegraphy, which has greatly enlarged the scope of all astronomical work, but, even so short a time ago as the year 1917, the new methods had not been perfected to the point of practicability.

Another point that makes longitude observation a delicate operation is the minuteness of the fractions of time and arc which have to be taken into account. For instance, in Latitude $55^{\circ} 50' N.$ (approximate latitude of Pouce-Coupé) one second of longitude arc is equal to 0.8653 chains, and one second of time is equal to fifteen seconds of arc, or 12.98 chains. A navigator at sea is quite satisfied if he can establish his position within a mile or two; indeed the results of an observation taken under unfavourable circumstances may be ten miles out, and yet be of the utmost use and value to the Navigator. The above remark is made in order to emphasize the extreme refinement of astronomical observation required in order to locate a precise point on the earth's surface in survey operations as compared with that necessary to obtain a ship's position within a mile

or two. Such refinement is beyond the scope of the ordinary field instrument, or the ordinary field observer; it calls for large instruments of the "portable observatory" type and a highly specialized expert trained in their use.

Since the only telegraph line which crossed the 120th meridian, north of the mountains, was the single-wire Government telegraph line along Fort St. John road, and the telegraph office nearest to the 120th meridian was at Pouce-Coupé, the pier had to be established at that point.

Mr. F. A. McDiarmid, Supervisor of Standards of the Geodetic Survey of Canada, who has had long experience of such work, was appointed to establish the pier.

The following details have been obtained from Mr. McDiarmid and will give some idea of the splendid type of instruments used, the wonderful degree of precision made possible by the methods adopted, and the great number of observations taken in order to ensure reliability of the resulting mean. Interesting as these details are in themselves, the really important point is to show that they warrant confidence in the result—namely that the line established on the ground as the Interprovincial Boundary coincides with the true position of the 120th meridian of west longitude.

The point of known longitude from which the longitude of Pouce-Coupé pier was deduced was Ottawa—approximately 1780 miles distant.

The instrument used was a Cooke astronomical transit with a focal length of thirty inches and an object glass having a clear aperture of two and a half inches. It was mounted on a solid concrete pier built at a point convenient to Pouce-Coupé telegraph office.

Used in conjunction with the micrometer head of the telescope is a chronograph, and the cylinder on which the record sheet is wound is driven by clock-work, while the recording pen is operated electrically. In operation the chronometer breaks the circuit automatically every two seconds, and the pen records the breaks upon the moving sheet at equal linear intervals. The chronometer is so arranged as to indicate the beginning of each minute by either omitting the break at the fifty-eighth second, or by putting in one at the fifty-ninth second. The record of the exact time of the transit of a star is obtained as follows: The image of the star is bisected by the movable wire in the micrometer head when it enters that part of the field where it is desired to observe. A cut-in is arranged on one of the wheels of the micrometer that permits the making of the circuit when the strips in the wheel are opposite the contact spring. As the wire passes the various positions corresponding to contacts on the micrometer head the transit circuit is automatically made and produces a record on the chronograph sheet. Small fractions of a second may be read from the chronograph sheet by means of a scaling glass.

What the foregoing amounts to is that the record sheet of the chronograph is a plain graph of the sidereal time shown by the chronometer during the time of observation with a number of points on it indicating the exact moment at which the movable wire in the micrometer head passes prearranged readings

of the micrometer drum. As it is the business of the observer to keep the star under observation bisected by the movable wire, the foregoing means that all the points of contact indicated on the graph are so many automatically recorded positions of the star, both as to azimuth and time. As the essence of longitude observations is time, and the refinement of longitude observation must be expressed in small fractions of a single second of time, it will be obvious that no less perfect method of obtaining time records—to a thousandth part of a second—would give anything like the degree of precision of the above.



LONGITUDE PIER AT POUCE COUPÉ OCCUPIED IN 1917 BY F. A. MCDIARMID

Each time set consisted of twelve to eighteen stars. There were two such time sets taken on every good observing night, and an exchange of time signals between Pouce-Coupé and Ottawa were made after completing the first time set and before beginning the second. Considerable difficulty was experienced in the exchange of time signals, and, ultimately, it was necessary to install repeaters at Dunvegan and Edmonton to ensure the successful completion of the longitude work. In all seven independent determinations of the difference of longitude between Ottawa and Pouce-Coupé were obtained, with a total range of 0.066 seconds.

The tabulated results of the longitude observations are given in the 1919 Report of the Geodetic Survey of Canada.

The latitude of the pier was obtained by seventy-five observations on twenty-five pairs of stars by Talcott's zenith distance method, and was found to be $55^{\circ} 43' 03.83''$.

Altogether the work occupied 26 days from July 20th to August 15th, many nights being lost through bad wire connections and cloudy skies.

CHAPTER II

CONFERENCES OF REPRESENTATIVES—INSTRUCTIONS— METHODS OF SURVEY—BOUNDARY MONUMENTS

CONFERENCE OF 1921

A Conference was held at Edmonton in October, 1921, at which Mr. A. M. Narraway, Controller of Surveys, represented the Dominion Government, Mr. A. P. C. Belyea, Director of Surveys, represented the Alberta Government and Mr. J. E. Umbach, Surveyor General of British Columbia, represented the British Columbia Government, the Commissioners being in attendance.

The report of the above Conference includes various recommendations as to the extent and manner in which the Boundary Survey should be continued, all of which were subsequently approved by the three Governments.

Under the terms of the above report it was provided that the survey of the entire Interprovincial Boundary between the Provinces of Alberta and British Columbia, with the exception of part of the 120th meridian at the extreme northerly end of the two Provinces should be completed by the end of the 1924 season, and that the survey thus completed would be sufficient to meet existing requirements for some years.

The following program of work was laid down for the three field seasons contemplated, and provided:—

That in 1922 Mr. Cautley's division should complete the monument building and final survey of the $43\frac{1}{2}$ miles run by his division in 1920, from Monument 73-7 southerly to the north bank of Wapiti River, and should then proceed to continue the survey of the 120th meridian southerly to the summit of the Rocky Mountains, or to a point on the meridian beyond which, in the discretion of the Commissioner, it would not be economical or practicable to produce the line by ordinary methods other than those adopted by the topographical division.

That for the future, in view of the totally uninhabited nature of the country through which the as yet unsurveyed portions of the 120th meridian will run, and the great additional cost of transporting monument material through such country, concrete monuments should only be built at intervals of approximately six miles, and that the secondary form of monument¹ herein prescribed should be used at all intervening points.

¹ A description of the above secondary type of monument will be found under sub-heading "Boundary Monuments" in this chapter.

That in 1923 Mr. Cautley's division should survey the 120th meridian north from its present northerly terminus at Monument 84-5, near the 22nd Base Line, as far as the season will permit.

That in 1924 Mr. Cautley's division should be employed on the survey of the more important passes lying to the north of Yellowhead Pass.

That the topographical work of Mr. Wheeler's division be carried on as in the past from Yellowhead Pass northerly along the Boundary to its final intersection with the 120th meridian.

The Conference also recommended that the survey of Phillipps Pass be arranged for on the basis of an agreement arrived at between the Commissioners.

In Part I, Chapter IV, page 61 of the Commission's Report will be found a description of Phillipps Pass, and the peculiar formation which made the Commissioners unable to agree about its survey in 1914. It was proposed to submit the matter to arbitration, but nothing was at that time done about it with the result that there remained until 1924 a break in the survey of the Boundary at this point of about two miles. As the summit of Phillipps Pass is a mile wide and has no direct surface drainage, it is impossible to prove either of the contentions made by the respective Commissioners, and the Conference expressed the opinion that the matter should be cleared up while the Commission was still in existence. The Commissioners thereupon agreed upon a survey which should be a frank compromise between their respective claims.

CONFERENCE OF 1924

Another Conference was held at Edmonton in January, 1924, at which Mr. A. M. Narraway, Controller of Surveys, represented the Dominion, Mr. P. N. Johnson, Director of Surveys, represented Alberta and Mr. J. E. Umbach, Surveyor General of British Columbia, represented British Columbia, the Commissioners also being in attendance.

The report of the above Conference was subsequently approved by the three Governments represented and deals with the final season's field work, the arrangements necessary to the publication of the Commission's Report and Atlas and the final closing up of the Commission's work.

INSTRUCTIONS

The following program of work was laid down for the season of 1924, and provided:—

That Mr. Cautley should complete the Boundary survey at Phillipps Pass in accordance with the agreement entered into by the Commissioners at the 1921 Conference, before leaving for the main season's work.

That Mr. Cautley's division should then produce the 120th meridian as a triangulation survey, from ridge to ridge, southerly from Monument 61-4 on Mt. Torrens to its intersection with the summit of the Rocky Mountains. That

monuments of the secondary type provided for by the 1921 Conference should be established on the ridges, and in important valleys in so far as time permits. That such posts should be marked on ridges by having a cairn built over them, or in valleys by a regulation mound of stone or earth. That where the line passes through timbered country it should not be opened out except in as far as may be necessary for the purpose of making monument sites intervisible, or of emphasizing the location of monuments.

That the passes to be surveyed after the completion of the 120th meridian survey be Robson Pass, Sheep Pass and Miette Pass in order of importance as named. That the survey of Sheep Pass should be monumented with the secondary type of Boundary monument, but that concrete monuments should be erected in Robson and Miette Passes.

That Mr. Wheeler's division should continue the photo-topographical survey northward from the point at which it was discontinued in 1923 to the most northerly intersection of the 120th meridian with the watershed of the mountains.

That Mr. Wheeler's division should subsequently continue the photo-topographical survey along the line of Mr. Cautley's triangulation survey to the point of its commencement at Mt. Torrens.

The report recommended that on completion of the work all necessary steps be taken by the Privy Council of the Dominion Government and the Executive Councils of the Governments of Alberta and British Columbia to approve the report and confirm the surveys of the Commission.

The report also contained the following provision for the perpetuation of the Boundary survey:—

"In order to deal with all questions in connection with replacing of all monuments which may be destroyed or disturbed, the re-adjustment of any portions of the Boundary and the dealing with any matters concerning the Boundary, it is recommended that the Surveyor General of Canada, the Director of Surveys of Alberta and the Surveyor General of British Columbia be constituted a standing Committee to which all such matters may be referred."

METHODS OF SURVEY

The survey of the Boundary along the 120th meridian differs in no respect from that of any other governing line, such as a base line or an initial meridian of the Dominion Lands system of surveys, except in the method of chaining used and the types and location of monuments erected to mark the survey.

Since the object of the Boundary survey is to establish its location on the ground as clearly as possible, for the guidance of all who have occasion to recognize it, and also that surveyors may be able to connect future surveys with it as conveniently as possible, monuments were not established at regular, pre-determined intervals, but the sites were chosen with a view to their visibility

from either direction on the line, subject to a maximum distance of one hundred chains between monuments; it follows that most of the monuments have been built on the highest points of land crossed by the Boundary.

DIRECTION OF LINE

The direction of the line is controlled by astronomical observation. Observations are taken at as many points as possible, the object being to obtain not less than three complete azimuth observations at each observing station. Each time that an azimuth observation is taken it is necessary to observe the time of transit of a known star as a check on the time shown by the chronometer.

The instrument used is a six-inch micrometer block survey reiterating transit, 1912 pattern. It is difficult to believe that the art of precise-instrument making can ever improve very much on the above instrument, considered as a field transit designed for astronomic work, either in regard to the near-perfection of its scientific structure or to the degree of precision which is commonly obtained by Dominion Land Surveyors in its use. Granted a first-class set-up, either on rock or on good ground, it is no unusual occurrence for a set of five azimuth observations to show a gross spread, or difference, of only five seconds of arc, or a deviation from the mean of only two and a half seconds. When it is considered that an angle of two and a half seconds is subtended by a base of less than one inch at a distance of a mile, it will be realized that the instrumental error, apart from the personal error of the observer, must be almost negligible.

MEASUREMENT OF DISTANCES

Measurement of distance along the line between monuments is made by the transit and tripod method of which a detailed description is given in Part I, Chapter II, page 14 of this Report. Instead of a tripod with a flat head on which the exact point to which the end of the chain reached was marked with a pencil, referred to in the above description as having been used in the earlier years of the Boundary survey, a special chaining tripod has been designed and used on the survey of the 120th meridian. The chaining tripod has a graduated scale capable of being set in the line of direction, and a movable index point that may be clamped at the precise point on the scale which coincides with the final graduation of the chain.

Every course between monuments is measured twice by the above method, each measurement being taken with equal care and corrected for the mean temperature noted during the time which it occupies. The two separate measurements are given equal weight and the mean is adopted as the final measurement.

If, after their respective temperature corrections have been applied, the two measurements of any course differ from one another by an amount equivalent to four-tenths of a link per mile of the course's length, the course is measured a third time.

In the final field-notes of the survey, all measurements are shown in two ways:—first, as corrected for temperature only; secondly, as also corrected for elevation of the surface above sea-level. The latter is only used in the calculation of the true latitudes of all monuments. If the 252 miles measured along the 120th meridian could have been measured at sea-level, the distance would have been 202 feet less.

In every attempt to secure chainage measurements of unusual precision and accuracy, the ultimate factor of success lies in the character, ability and interest of the men who do the work. It is not the least merit of the system described above that it demands the services of qualified instrument men to operate it, and that the necessity for checking every measurement made, within very small limits, stimulates them to use extraordinary care. During the seasons of 1919 and 1923, in which 126 miles of the Boundary were surveyed, the average difference per mile of the two separate measurements of each course amounted to less than one inch.

LEVELLING

Levels were taken all over the line surveyed along the 120th meridian, the datum adopted being based on the line of precise levels established along the Fort St. John wagon road.

From Monument 66-5, near Wapiti River in township 66, to Monument 97-5, at the end of the work in township 97—a distance of 186.9 miles—the altitude of all monuments was ascertained by spirit-levelling, except only at Peace River, across which the levels were carried by reciprocal trigonometrical levelling.

All levels along the line were checked by an independent operation.

South of Wapiti River, from Monument 66-5 to Monument 56-0 at the intersection of the meridian with the summit of the Rockies—a distance of 65.3 miles, all levels were carried by reciprocal trigonometrical levelling.

Level ties were made from the Boundary Line of levels to bench marks on the 17th, 18th, 19th, 20th, 21st, 22nd, 23rd and 24th Base Lines respectively.

LINE-CUTTING

All the country through which the Boundary along the 120th meridian passes is covered by timber throughout.

The Boundary line is cut out wide enough to give a clear opening to the sky of six feet, which means that it is from ten to sixteen feet wide on the surface according to the nature of the timber. Where the line passes through muskeg covered with small, stunted spruce the party had no difficulty in cutting two miles of line in a day. On the other hand, when the line passes through heavy timber the party could only make half a mile in a ten-hour day, even when the ordinary line-cutting crew was augmented by everybody in camp except the cook. It is a curious fact that the easily-cut line through the muskeg will

remain clear for perhaps fifty years, whereas the lines cut through heavy bush will grow up much more quickly. This is due to the extraordinarily slow growth of timber in muskeg.

Wherever concrete monuments were built the ground was cleared for a space having a twenty-foot radius from the monument, partly to make the monument conspicuous but more particularly in order to afford it protection from bush fire.

MAGNETIC DECLINATION

Observations to determine the magnetic declination of the compass needle were taken at various points along the 120th meridian.

CONNECTIONS WITH PREVIOUS SURVEYS

Wherever possible carefully surveyed connection was made with all pre-existing surveys, particularly with those Base Lines which form the framework of the Dominion Lands System of surveys. Owing to their importance as governing lines, Base Lines are very carefully surveyed. But Base Lines are not only lines of survey projected far beyond the limits of settlement and civilization as a base for the surveys of the future; they have a greater value and a more romantic interest as lines of exploration. Base Lines have an unexpected trick of running into rivers, that would be called "big" anywhere else than in Canada, miles away from where such river is shown on the latest previous map. They are the sources of information from which the heads of survey departments decide on future policies, and which enables them to avoid waste of public money on subdivision surveys of areas unsuitable for settlement. They generally afford the only reliable data of elevations and surface conditions that are immediately available to those who are considering the probable route of a possible railway.

No less than nine Base Lines, from the 16th to the 24th inclusive, were tied in by surveyed connection to the Boundary survey.

BOUNDARY MONUMENTS

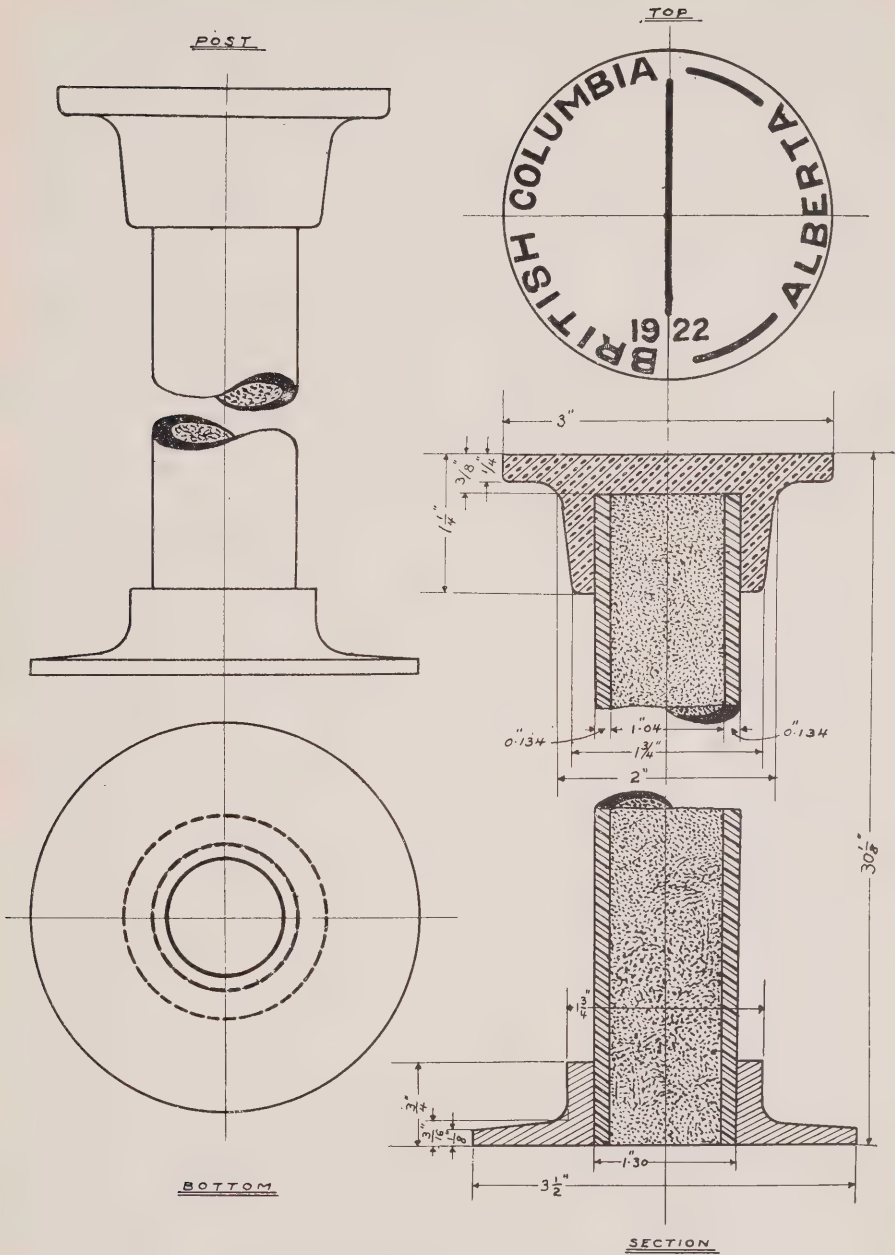
Two types of monuments have been used to mark the survey of the Inter-provincial Boundary along the 120th meridian; the first is the concrete monument so fully described in Part I, Chapter II, pages 17 and 18 of this report, and the second consists of a standard Dominion Lands Survey post with a specially designed bronze cap, and a mound and trench or a stone mound.

Diagram I shows the standard Dominion Lands Survey post with the special bronze cap designed for the Boundary monuments.

Diagram II shows the position of the post with respect to the mound and trench, the dimensions of the two latter, and the rock post.

An alternative form of the above secondary Boundary monument consists of the special bronze cap fitted with a short shank—four inches long—which is cemented into rock when it is necessary to establish a monument of rock.

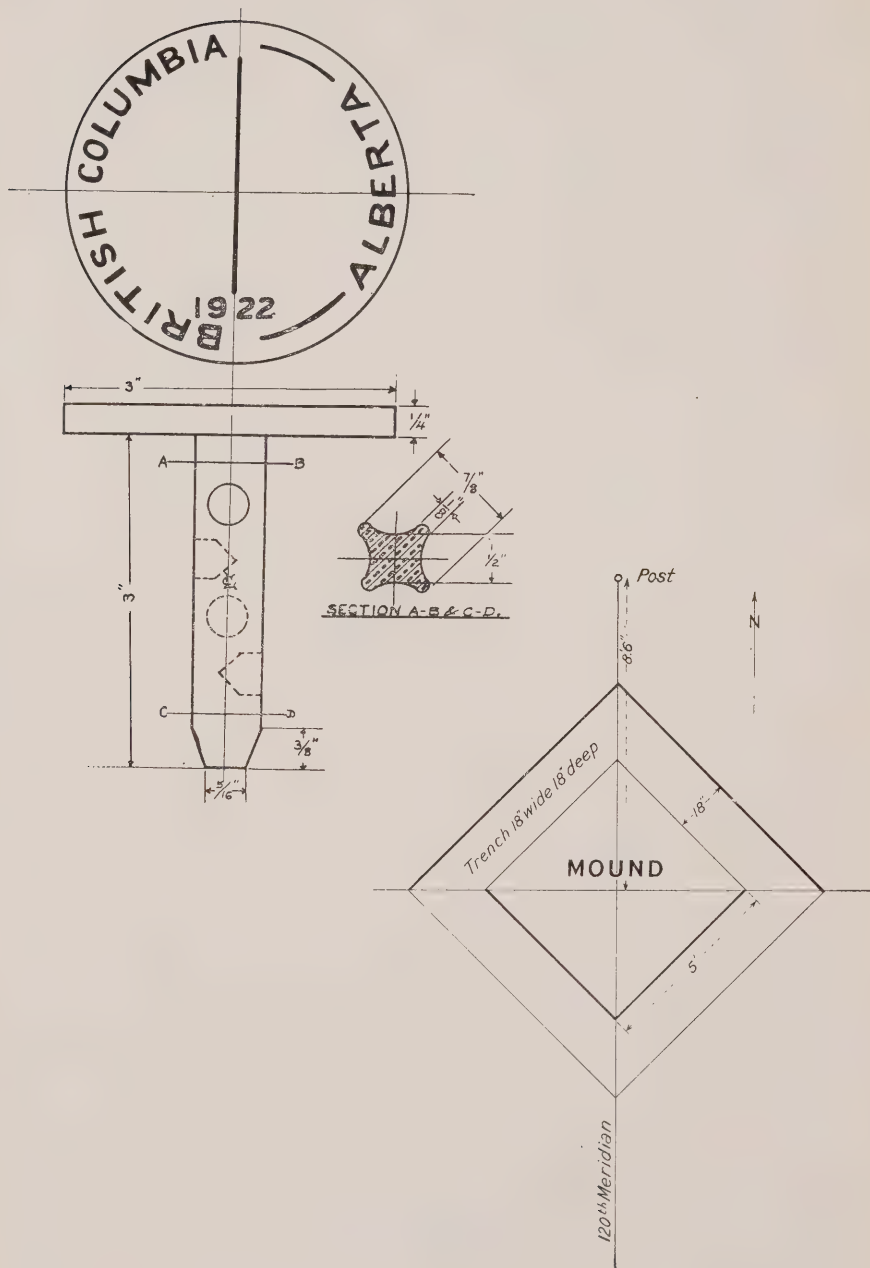
DIAGRAM I



ALBERTA-BRITISH COLUMBIA
SURVEY POST

ROCK SURVEY POST

DIAGRAM II



There is no comparison between the relative merits of the concrete monument and the secondary type of monument. On the other hand, the secondary monument is of a very permanent type, and was designed and authorized by the 1921 Conference in order to avoid the immense cost of transporting monument material to parts of the Boundary far removed from railway, steamboat or wagon facilities of transportation. Apart from the cost of transporting cement, forms, etc., by packtrain, for distances in some cases over 100 miles over rough survey trails, much of the 120th meridian passes through country where it was impossible to secure gravel within reasonable distance of the monuments to be built.

Concrete and Secondary Type Monuments.—From Monument 56-0, at the intersection of the 120th Meridian with the summit of the Rocky Mountains, to concrete Monument 62-3, just north of Narraway River, a distance of 38·3 miles, all monuments are of the secondary type.

From Monument 62-3, the most southerly concrete monument built, to concrete Monument 66-4, on the south bank of Wapiti River, a distance of 26·7 miles, a concrete monument was built at intervals of about six miles and all intervening monuments are of the secondary type.

From Monument 66-4 to concrete Monument 84-5, twelve miles north of Peace River, a distance of 109·7 miles, all monuments are of the concrete type with the single exception of Monument 67-6, which occurs on a low ridge in the middle of a big muskeg and is of the secondary type.

From Monument 84-5 to Monument 97-5, being the final northerly monument erected by the Commission, a distance of 77·7 miles, all monuments are of the secondary type.

Marking of Monuments.—All Boundary monuments have the words "ALBERTA" and "BRITISH COLUMBIA" plainly marked on those sides of the monument which faces towards the respective Provinces.

In addition it was necessary to mark each individual monument with some distinctive mark of identification.

In the case of Boundary monuments on the 120th meridian it was decided to mark each monument with the number of the township of the Dominion Lands System in which it occurs, followed by its number in order from the south boundary of such township. Thus the first monument built north of the south boundary of township 78 is marked "No. 78-1," and the next monument to the north "No. 78-2" etc. One merit of the above method of numbering lies in the fact that it affords a universally applicable system of marking monuments on the 120th meridian for any part of the line, irrespective of whether it was surveyed north or south from the initial point established.

Brass name-plates of concrete monuments are marked in the field as previously described in Part I of this Report.

Bronze caps of the secondary type of monument are marked with steel dies.

Photographs.—Photographs were taken of all concrete monuments, and reproductions of some of them will be found in the Appendix to Part III-B of the Report.

Photographs were also taken with a view to illustrating and lending interest to certain features of the Report. For instance, no written description of a hitherto unknown river can ever convey so true an idea of its appearance and general character as may be gained in a moment from a good photograph. However, whereas photography is a prime factor in the work of the phototopographical division, photography on the 120th Meridian survey had to be regarded as a secondary consideration which must not be allowed to interfere with the general progress of the work. As a result many views were taken under conditions of poor light, while others that were desirable were never taken at all.

TRIANGULATION METHODS IN MOUNTAIN SECTION OF 120TH MERIDIAN

The south 38.29 miles of the 120th Meridian survey, from Monument 56-0 at the intersection of the meridian with the summit of the Rocky Mountains to Monument 62-3 on the north bank of Narraway River, are entirely mountainous in character and were surveyed by triangulation methods throughout.

In order to fulfil the special objects of the survey it was necessary to conduct three separate and distinct operations. First, the 120th meridian itself had to be surveyed and monumented as a straight-line boundary. Second, a triangulation net had to be carried forward in the vicinity of the 120th meridian, so that the distances between monuments could be ascertained. Third, a photographic survey of the confused mountain topography of the region was required. The first two were undertaken by Mr. Cautley's division, and the third by Mr. Wheeler's.

CHAPTER III

CHRONOLOGICAL PROGRESS OF THE SURVEY OF THE 120TH MERIDIAN

SEASON OF 1918

Owing to the fact that the survey of the 120th meridian was begun in 1918, the last year of the War, the Governments were unwilling to make a large appropriation for the survey, or to have a large party of men employed on survey work. At the same time it was desired that the survey of the 120th meridian should be started, so Mr. Cautley was sent out with a small party to establish an initial point on the meridian from the longitude pier which Mr. McDiarmid had established at Pouce-Coupé and to carry the survey south as far as possible from such initial point.

The party, composed of Mr. Cautley and five men with fifteen pack-horses, left Edmonton for Grande Prairie by the Edmonton, Dunvegan & British Columbia Railway on the 13th June.

The distance from Edmonton to Grande Prairie is 244 miles in a straight line but is 402 miles by the more or less circuitous route of the railway. The road-bed was in very bad condition and was the cause of various delays due to derailments and a wash-out on the Smoky Hill.

Two additional men were engaged at Grande Prairie and the party left that point for Pouce-Coupé on the 20th June, by Fort St. John wagon road.

FORT ST. JOHN WAGON ROAD

From Grande Prairie to Pouce-Coupé, the distance by the Fort St. John wagon road is about 84 miles in a general north-westerly direction; it crosses the Boundary near the south-easterly corner of Swan Lake, nineteen miles before reaching Pouce-Coupé.

For the first thirty miles out of Grande Prairie, to a point a few miles west of Beaverlodge, the road is fairly well graded, but the remaining 54 miles were little better than a rough wagon track in 1918. Since that time, however, a great deal of work has been done on the road, particularly on the nineteen-mile section in British Columbia which used to be a mere track through the woods, that was almost impassable in wet weather, but is now a wide and well-graded road. Beyond the Settlement of Pouce Coupé, the Fort St. John wagon road still extends as the roughest kind of a wagon trail for about 38 miles to the banks of the Pine River, where it abruptly ends. At the present time the trail crosses Coal Creek and Kiskatinaw River on such steep and water-worn natural grades

as to reduce its usefulness to that of a pack-trail. A few wagons are laboriously hauled over it every year but it is not really practicable for any kind of wheel freighting. Here again the British Columbia Government is undertaking to build a real wagon road from Peace River ferry at the Flat near Taylor P.O. to Pouce Coupé Settlement.

The Government telegraph line follows the Fort St. John wagon road all the way from Grande Prairie to Fort St. John.

Fort St. John wagon road has been a very important freight route ever since the Pouce Coupé district began to be settled in 1910, because it affords the only practicable means of communication with the railway at Grande Prairie



VILLAGE OF POUCE COUPÉ IN 1918

during the summer months. In the winter there is a good sleigh trail from Pouce Coupé to the railway at Spirit River—a distance of only sixty miles as compared with 84 miles to Grande Prairie—but it is too wet for wheeled traffic in the summer.

The party arrived at Pouce Coupé on the 26th June, 1918. At this time the village consisted of six buildings, but there were more than three hundred buildings in 1922.

ESTABLISHMENT OF INITIAL POINT ON 120TH MERIDIAN

Mr. McDiarmid determined the longitude of his pier at Pouce Coupé to be $120^{\circ} 07' 58.8''$ W. in latitude $55^{\circ} 43' 03.9''$. The pier is therefore 415.518 chains west of the 120th meridian, and it was necessary to establish an initial point on the meridian by surveying the above distance easterly from the pier. The connecting survey called for extreme care since any error in its measurement would have resulted in the entire Boundary being out of place by the full amount of such error. The connection was made along the north boundary of township

77 and chained twice by the transit and tripod method, after the chain had been very carefully compared with standard tapes.

As soon as the above survey had been made, concrete Monument 78-1 was built 3.079 chains north of the north boundary of township 77 and forms the initial point from which the survey of the 120th meridian was subsequently carried north and south.

The rest of the season was occupied in carrying the survey of the 120th meridian south through townships 77, 76 and 75 to a point about one and a half miles south of its intersection with Fort St. John wagon road and telegraph line.

Description of the country traversed will be found in Chapter 4, under sub-headings Townships 75, 76 and 77.



JOHNSON FARM ON NORTHEAST QUARTER SECTION 10, TOWNSHIP 72-10-6

Surveys were made to connect the survey of the Boundary with the previously surveyed north boundaries of townships 76 and 77.

Levels were taken along the Boundary from a benchmark on the 20th Base Line (north boundary of township 76). The above levels were tied on to a bench mark on the line of precise levels established along Fort St. John road, and the altitudes assigned to monuments in this Report are based on the datum of the latter bench mark.

Twenty-one concrete monuments were built during 1918.

At the close of the season the party returned to Grande Prairie on the tenth and arrived in Edmonton on the 15th October, where they were paid off.

SEASON OF 1919

The programme of work agreed upon for the season of 1919 consisted of producing the 120th meridian six miles south from the point at which it had been left at the end of the 1918 season, and then carrying it as far north from

Monument 78-1, which had been established as the initial point of the survey in 1918, as the length of the season would permit.

The party consisted of Mr. Cautley, his assistant, Mr. J. T. Carthew, D.L.S., fourteen men and 24 pack-horses.

With the exception of Mr. Cautley and his head packer—both over military age in 1914—and one other man who was still under age in 1918, every member of the party was a returned soldier. Most of them had been wounded at least once, three of them had been decorated for conspicuous bravery and all but one had seen active service in France. Mr. Cautley takes pleasure in recording the fact that every man on the outfit did his work faithfully and well, and that the party as a whole was the most all-round efficient and reliable within his experience. Mr. Cautley particularly desires to express his appreciation of the work done by Mr. Carthew, who did all the hypotenuse chaining and levelling, and in whose capable and painstaking work he has every confidence.

The party left Edmonton in two detachments, on the 5th and 9th days of June. Owing to the so-called "sympathetic strike" of May and June, 1919, trouble and delay was experienced in obtaining railway express and freight, but finally the party left Grande Prairie on the 14th June and arrived at the end of the work done in 1918 on the 19th June.

From the 20th June to the 5th July was occupied in continuing the 120th meridian south from Monument 74-8, being the most southerly point of the line run in 1918, to Monument 73-7 which is about a quarter of a mile south of the north boundary of township 73.

On the 7th and 8th July the party moved 21 miles north to Monument 78-1.

From the 9th July to the 1st October the survey was run continuously north, from Monument 78-1 to Monument 84-5 which is 63·060 chains south of the north boundary of township 84, or 22nd Base Line. The Peace River was crossed in township 82.

Altogether 48 miles of the Boundary were surveyed, exclusive of surveyed connections with former surveys, and fifty concrete monuments were built.

During the season of 1919 all levels were taken by Mr. Carthew. Direct and check levels were run between all monuments except between Monuments 79-2 and 79-4 across Sergeant Creek, between Monuments 79-6 and 79-7 across Pouce Coupé River and between Monuments 82-5 and 82-7 across the Peace River. In the first two cases it was found that, owing to the extremely rough character of the ground, the general progress of the survey would be delayed if the check levelling were done in the usual manner, so a single line of levels was run and the checking was done by trigonometrical levelling. In the case of the Peace River crossing it was quite impossible to take levels anywhere near the Boundary itself, and it would have been necessary to cut out a special line of some miles in length, through heavy bush, in order to permit of spirit levels being taken at all. It was therefore decided to carry the levels across the river valley by reciprocal trigonometrical levelling. Closings were made on recorded bench marks on both the Twenty-first and Twenty-second Base Lines.

Description of the country traversed will be found in Chapter 4, under sub-headings of townships 74 to 84 respectively.

Having returned to Peace River, the party built a raft thirty-two by sixteen feet, on which to travel down the river.

On the 4th of October, the horses, in charge of the head and second packers, swam across Peace River and started south for their winter quarters at Entrance on the Grand Trunk Pacific Railway, via Grande Prairie and the Edson Trail, a distance of about 260 miles. The rest of the party left on the raft at noon of the 4th October and arrived at the town of Peace River on the 9th. The



SURVEY OUTFIT RAFTING DOWN PEACE RIVER

distance from the Boundary to Peace River is approximately 150 miles and the raft took fifty-five hours of actual floating time to make the journey, but, of course, the rate of travel would be very much faster at times of high water.

PEACE RIVER

Peace River is the noblest of the three great rivers which traverse the Province of Alberta. From the Report on "Arctic and Western Hudson Bay Drainage" issued by the Dominion Water Power and Reclamation Service of the Department of the Interior, it appears that the annual run-off from Peace River, measured at the town of Peace River, is approximately four times as great as that from Athabaska River, measured at the town of Athabaska, and nine times as great as that from the North Saskatchewan River, measured at Edmonton. The average annual run-off from Peace River, measured at Peace River over a period of five years, was found to be 1,890,504 millions of cubic

feet. In 1920 the maximum discharge occurred on the 3rd July and was thirty-six times as great as the minimum discharge which occurred on the 24th March. The river is about 1000 feet wide at the Boundary and gradually increases to a width of 1300 feet at the town of Peace River—just below the entrance of Smoky River, which is the only notably large tributary that it receives in the intervening distance. In times of normal high water the current varies from three to six miles per hour. The river is navigable from its entrance into Alberta at the Boundary for about 500 miles to the Vermilion Chutes, which are fifty miles downstream from Fort Vermilion. The Chutes are half a mile long and constitute a formidable obstruction which effectually prevents continuous steamboat traffic, although scows can be lined down them. Below the Chutes the river is navigable all the way to its confluence with Slave River, about 130 miles further on.

The valley of Peace River is deep and somewhat constricted for so large a river, varying in depth from 600 to 1,000 feet and in width from one to three miles between broken edges of the general plateau. Below the town of Peace River the depth of the valley gradually decreases.

One of the remarkable features of Peace River is that it pierces the Rocky Mountains and drains an enormous intramontane watershed area through its two radical tributaries, the Parsnip and Finlay Rivers. It is not generally realized that about twenty-seven per cent of the total area of the Province of British Columbia lies within the Mackenzie watershed, or that, for more than three hundred miles west of the 120th meridian, the north Boundary of British Columbia lies east of the mountains, in the basin of that other great tributary of the Mackenzie, Liard River.

The party arrived in Edmonton and was paid off on the 11th October.

SEASON OF 1920

During the season of 1920, on recommendation of the Commission approved by the three Governments concerned, the survey of the 120th meridian was continued south from Monument 73-7, the southerly end of the work done in 1919, with the final object in view of completing the survey to the Rocky Mountains in two years.

Owing to the fact that very little was known of the country to be traversed, of the difficulties of line-cutting and trail-making that would have to be overcome, or the possible sources from which gravel might be obtained for the concrete monuments, it had been decided to spread the work over two seasons. The first was to be spent in cutting out as much line as possible, selecting sites for the monuments and supplying them with the 2,000 lbs. of gravel required for the construction of each monument. In addition it was required to make a topographical survey of the country for a mile and a half on either side of the Meridian. During the second season it was planned to build the monuments and complete the survey of the line run during the first and to carry on the line as a completed survey into the mountains.

The party consisted of Mr. Cautley, his assistant Mr. D. M. Robertson, D.L.S., and 18 men with a packtrain of thirty horses.

The country traversed by the 120th meridian from Monument 73-7 towards the mountains in the south is a high, gently undulating plateau with an irregular but constant rise to the south and west, so that each succeeding height of land



CUTTING THE LINE ON 120TH MERIDIAN IN TOWNSHIP 68

crossed in a southerly direction is appreciably higher than the last. Thus, while the altitude of Monument 73-7 is 2882 feet above sea-level, the altitude of Monument 63-6, approximately sixty miles further south, is 5192 feet, and the many intervening ridges all show a gradual increase in altitude from the former to the latter.

The surface for a few miles to the east of the Boundary and for many miles to the west of it is very similar throughout, being cumbered with heavy, wind-

fallen brûlé to a height of from three to seven feet, interwoven with dense, small second-growth jackpine. The windfallen brûlé creates a condition which carries with it a constant menace of further fires.

Apart from the possible discovery of minerals, the future value of such country as that described above, wherever it may be, and there are millions of



CUTTING THE LINE ON 120TH MERIDIAN IN TOWNSHIP 68

acres of it in the Northwest, lies in its timber. Timber is the one form of vegetable growth of which the roots strike deep enough beneath the "soil-burned" surface and in which the natural growth is slow enough to wait for, and at the same time help forward, the slow process of soil-renewal in a fire-devastated area; in fact it is well known that reforestation is nature's only and unfailing method of repairing such impoverishment as fire causes in surface soil. In a great many places there are vigorous stands of young spruce growing up through

the old brûlé, but it is almost certain that they will be destroyed by fire before reaching commercial value, because, sooner or later, the brûlé will carry fire through them. It is suggested that the first move towards restoration of value in all areas similar to that described above must be in the direction of clearing the brûlé by controlled fires, or at least by clearing enough wide lanes through it to prevent fire running wild all over the country.

In the meantime the windfallen condition of the country is so universal, and it is therefore so difficult of access, that there are numbers of moose roaming through it, although it is comparatively close to considerable settlements. It is most extraordinary how moose can, and will, range through the most difficult windfallen country; signs of moose were seen everywhere, and frequently in such places that the animal must have got over heavy logs five feet off the ground in order to pass.

There were no existing trails and it was found best to cut out the line itself wide enough and clean enough to make a trail for all the heavy packing that the building of concrete monuments entails. Ordinarily it is more economical to locate a horse trail off line, because a trail can generally be found which avoids most of the natural obstructions and saves much heavy chopping on line. In this particular instance there were two good reasons for following the line; first, that it was impossible to locate any off-line trail that would not have called for an immense amount of work, owing to the ubiquitous brûlé; and second, that wide detours were out of the question, since it was essential that the trail should touch the line at all monument sites (situated about a mile apart) in order that the 2700 lbs. of material required for each monument might be delivered.

The only important stream crossed by the survey of 1920 is Redwillow River which crosses the Boundary in a general north-easterly direction near the north boundary of section 12 in township 70. It is a pretty stream with wide, gravelly bed about 100 feet below the general plateau level, bordered by small flats of rich bottom land alternating with cut banks. There is a small amount of good spruce timber on some of the flats.

In the first week of August, 1920, after much hot, dry weather, the stream itself was only 70 feet wide, with an average depth of six inches and a current of perhaps one and a half miles per hour. On the other hand, when the party crossed it on the 30th September, after a prolonged spell of extraordinarily wet weather, the stream was 150 feet wide with an average depth of twenty-two inches and a current of about two and a half miles per hour.

The Redwillow enters Wapiti River twenty-six miles due east from where it crosses the Boundary.

Small pieces of float coal were found on the gravel-bars of Redwillow River. Further downstream there are some small coal mines, worked principally by homesteaders in a very primitive way, from which coal is hauled to Grande Prairie in the winter. The coal is hard, bright and jet-black with sharp, almost glass-like cleavages. It is very volatile and burns well, but Grande Prairie

users say that it is rather difficult to control, being apt to cause explosions if damped down too quickly.

The season was remarkable only for the unusual precipitation during September. For seventeen days, from the 11th to the 27th September, it rained or snowed for a part of every day, including seven days and nights of continuous rain or snow.

During the season forty-three and a half miles of most unusually heavy line were cut out and forty-four monument sites were selected, of which thirty-three were supplied with gravel. Surveyed connections were made with the north boundaries of townships 72 and 68, the nineteenth and eighteenth Base Lines respectively.



REDWILLOW RIVER AT THE BOUNDARY CROSSING

On the 28th September the survey was discontinued at the site of Monument 66-5, being at the top of a 500-foot cut-bank on the north side of Wapiti River.

Detailed description of the country traversed will be found in Chapter 4 under subheadings of townships 66 to 73 respectively.

The party returned to Edmonton via Grande Prairie, arriving on the 6th October, when they were paid off.

SEASON OF 1922

During the season of 1921 no work was done on the 120th meridian, both divisions of the Commission being employed in finishing up the mountain section between Kicking Horse and Yellowhead Passes, in order that the publication of the second part of the Commission's Report might be proceeded with.

In 1922 the work to be done consisted of completing the 1920 programme as already outlined, i.e. monumenting and making final survey of the 43½ miles cut out in 1920, and carrying the survey into the mountains.

PLACING OF CACHES

It will be seen that an outstanding feature of the above season's work would consist in the transportation of a large bulk of monument material. The total weight of outfit required for the season's operations amounted to 40,000 lb., including 22,000 lb. of cement, 14,000 lb. of supplies and 4000 lb. of camp outfit. Besides the above 40,000 lb. of general freight, it was also necessary to provide for the transportation of about 40,000 lb. of gravel that would be required for the construction of concrete monuments. As there are no roads of any kind along the line to be surveyed, or waterways that would permit of water transportation, it meant that 80,000 lb. would have to be handled by the packtrain, apart from ordinary camp-moving work.

Under the above circumstances it was essential to the success of the season's work that as much freight as possible should be placed at convenient points on the line before the actual commencement of surveying operations. Otherwise the packtrain service would have been quite unable to keep pace with the progress of the survey. It was therefore decided to try to place four caches in close proximity to the line by winter freighting. Of the above four caches three were comparatively small, consisting of cement and other monument material only; they were placed at Fritton Lake in township 72, the Boundary crossing of Redwillow River in township 70 and at a point near the Boundary crossing the Lattice Creek in township 69. As rough winter trails cross the Boundary at all three of the above points no difficulty was experienced in regard to them.

The most important cache which it was necessary to make was one of 24,000 lb., including most of the food supplies besides cement, on Wapiti River, somewhere near the Boundary and such that a packtrail could be found to it from the high land on either side. There are no roads within thirty miles of the desired point, and the intervening country is so encumbered with windfallen logs as to make the construction of even a rough winter trail out of the question, so the only alternative to taking the freight in on pack-horses was to freight it up the river itself, on the ice. On enquiry, it was found that the settlers of the district had never done any winter freighting on the Wapiti, and considered it dangerous. However a farmer, named Alex. McIntosh, was found who agreed to make a trial trip if Mr. Cautley would go with him, and to take a contract for delivery of the freight if the route was found practicable, although he frankly expressed the opinion that it would be found otherwise. Accordingly, Mr. Cautley with McIntosh and one other man made a trial trip with a powerful team at the end of January and first half of February.

Wapiti River is from 300 to 500 feet wide, with a narrow, constricted valley between steep banks from 500 to 900 feet high and with a current of from

five to seven miles an hour. The banks are so uniformly high and steep that there are only a few places where it is possible to make a crossing even with pack-horses. The last settler along the river, in an upstream direction, is a man named Chase on section 10, township 69, range 10, being forty miles downstream from the intersection of the Boundary. There is a steep sleigh trail down to the river at Chase's, which was the nearest point to the Boundary where it was possible to get the team down to the river. The trail was so steep that the outfit turned completely over on its way down. The party was able to get the team 37 miles upstream from Chase's to the crossing of Calahoo trail—an old Indian hunting trail—but could get no further on account of rough ice. Having surveyed the river for three and a half miles on either side of the Boundary and built a substantial log cache, the party returned and the freight was afterwards successfully delivered at the cache.

Upstream from Chase's there are no settlers whatever and only one snowshoe track was seen, made by a solitary trapper named Osborne. Osborne told Mr. Cautley that he had trapped along the river for some years and that he had never seen the river ice so good as it was then, adding that it generally froze in jams so that teams could not travel on it.

Osborne went on up Narraway River; he had a sled and four dogs but neither tent nor stove, and for an entire week after Mr. Cautley's party met him the temperature varied from minus 30° to an extreme minimum of 58° below zero. There are dozens of these solitary trappers scattered all through the North country and it seems extraordinary that so comparatively few of them meet disaster.

FIELD WORK

Mr. Cautley's party for the season's work consisted of himself, his assistant, Mr. A. O. Gorman, D.L.S., and eighteen men with a packtrain of thirty-two horses.

Mr. Cautley's previous assistants had been first class men and did excellent work, but they had all been young men with very little previous experience. At the 1921 Conference it was considered advisable that Mr. Cautley should have a more experienced assistant, so that he might be more free to devote himself to the work of general organization and supervision. Mr. Gorman had a well-established reputation as a first class field man and was appointed as Mr. Cautley's assistant for the three remaining years of the Commission's work.

The party was assembled at Grande Prairie on the 30th May and, next day, proceeded on its way to the end of the 1920 work on the north bank of Wapiti river.

Some delay was experienced at Wapiti River; in the first place, the water was high and everything had to be transported across the river in an eleven-foot canvas boat which would only carry 450 lbs. including the crew; in the second place, the survey had to be carried across the river, and the line was five miles by trail from the camp, although only one and a half miles by direct distance, and, in the third place, it was found that a considerable quantity of provisions

which it was necessary to replace, had been stolen out of the log cache. However, on the 12th June everything had been so arranged that it was possible to move the entire outfit across the river without having to recross until the 5th August, when the southerly production of the line had been completed. The horses swam and everything else, including saddlery, was transported in the canvas boat.

From the 12th June to the 2nd August the survey progressed steadily south a distance of thirty-one miles to where it passes over three westerly spurs of a big mountain which Mr. Cautley named Mt. Torrens.* The last monument on the line is a standard post marked "61-4" surmounted by a cairn; it is on a well-defined rocky ridge leading direct from the summit of Torrens, from which it is about thirty chains west and a little south. Monument 61-4 is very nearly in the middle of township 61.



WAPITI RIVER UPSTREAM FROM CROSSING OF CALAHOO TRAIL

Besides the monuments on the 120th meridian itself, the summits of Torrens and two other mountains to the northwest were occupied as triangulation stations, and cairns built at them. In the case of Torrens summit a cairn eight feet high with a perimeter of twenty-seven feet round the base was built, so as to leave a very distinct mark for Messrs. Wheeler and Lambart when projecting their triangulation surveys from the south.

Unfortunately bush-fire smoke prevented useful observation—let alone photography—of the country to the south of Torrens. Most of the time it was impossible to see any distance at all, and even when the smoke lifted a little it was so hazy that any estimate of distance was difficult, and apt to be very inaccurate. It was impossible to form any estimate of how far it might be along the 120th meridian from Monument 61-4 to the summit of the Rockies. The fact was sufficiently clear, however, that all the intervening country was so

*The name Torrens Mountain was subsequently approved by the Geographic Board of Canada.

mountainous in character as to preclude the idea of carrying on the survey by methods other than those of triangulation and phototopography. Accordingly Mr. Cautley left the survey on Mt. Torrens and turned back to complete the other part of his season's work.

From the 22nd to the 25th July Mr. A. M. Narraway, Controller of Surveys, made a visit of inspection to Mr. Cautley's camp at Narraway River.

Narraway River heads up into a splendid mountain sheep country, and was therefore known as Sheep Creek for many years. As one of the main tributaries of Smoky River—not thirty miles distant—is also known as Sheep Creek, the Geographic Board of Canada named it Narraway River in honour of Mr. Narraway.



B-13 IN ACTION

On the 5th August the party got back to Wapiti River camp, where five axemen were discharged as being unnecessary to the economical conduct of the work still to be done. This work consisted of building forty-three concrete monuments and precise chaining and levelling $43\frac{1}{2}$ miles of line which had been cut out in 1920, and it was all completed in twenty-nine days of actual work between the 7th August and 9th September. When it is realized that 58 tons of monument material were built into 43 monuments served only by packtrail; that, for the greater part of the time, two monuments were completed every day, and the two tops for the morrow's monuments filled, which meant, among other things, that forms, cement, water and gravel had to be supplied by pack-horse to four monument sites about a mile apart each day, it will be apparent that no time was lost, and indeed Mr. Cautley reports that he had an excellent party throughout.

The weather throughout the entire season was extraordinarily fine. From 30th May to the 25th September the party lost only five and a half days of working time, of which one and a half days were due to bush-fire smoke in the vicinity of Mt. Torrens, where the trigonometric nature of the work necessitated long sights.

Due in part to the dryness of the season, and partly probably to the continued presence of bush-fire smoke, the comparative freedom from mosquitoes was remarkable.

Bush fires were burning right across the Boundary on the north side of the Wapiti all summer, and the party was very fortunate in not being hindered by them. For instance, on its way to the work, the party camped at Calahoo



SWIMMING HORSES ACROSS THE WAPITI

Lake over Sunday, 4th June, in dense smoke. On the 5th June it snowed all day and it was found on the following day that the snow had put out a bad bush fire which was directly in their path and might easily have caused considerable loss of time. When it came to making the final survey of the line north of the river, in August and September, there were active bush fires on both sides of the line which had crossed it in many places but which did not interfere with progress. On the south side of the river no bush fires were encountered until Mt. Torrens was reached, whose southwesterly slopes—beyond the survey—were on fire. Here again the party was fortunate as a gale of wind fanned this fire to such activity that the party would in any case have been forced to retire across Narraway River the very day after they actually did so, having completed their work. Although there was only the one—strictly local—fire south of the Wapiti, there was an almost constant smoke haze from British Columbia. In

this connection it is rather a curious fact, which must often have been commented on before, that the prevailing winds on the east slopes of the mountains come from the west or southwest for nine days out of every ten.

The only real loss to the season's work caused by fire and smoke occurred through the consequent inability to take landscape photographs or to make long distance sights for topography—particularly south from Mt. Torrens, where much valuable information might otherwise have been obtained.

There was a good deal of float coal seen in the beds of the streams crossed, and a small stringer seam of coal crops out on the very summit of Mt. Torrens. Some of the party made a small fire using some of it.

North of Wapiti River there were a great many moose in 1920, but there did not seem to be so many this year, owing probably to bush fires. South of Wapiti River is an ideal moose and cariboo country and a number were seen; the men even caught one little moose calf asleep on line and sent it off—a wild contortion of loosely-assembled legs—after its mother. Beaver were seen on Huguenot and Hiding Creeks. On Mt. Torrens mountain sheep, moose, deer or caribou were seen on every occasion when an ascent was made. A few bears were seen. Ruffed grouse and prairie chicken were very plentiful everywhere, and ptarmigan were plentiful on the mountains.

During the season 31.3 miles of line were cut out, and 43.5 miles of old line were cleared out; 74.8 miles of line were chained by precise methods; 43.5 miles of line were levelled; 49 concrete monuments were built, and 27 of the new-style standard post type of monuments, with trench and mound, were established. There was also a great deal of painstaking topographical exploration work done on either side of the line.

Having returned to Edmonton, the party were paid off on the 17th September. Mr. Cautley and three men proceeded to Fort St. John, where he had made arrangements to have the horses wintered, and arrived at Edmonton on the 30th September.

GENERAL DESCRIPTION OF COUNTRY

The country traversed by the 120th meridian from the north boundary of township 73 to Wapiti River in township 66 has already been described as a high, gently undulating plateau with a slight but constant rise to the south and west, so that each succeeding height of land crossed in a southerly direction is appreciably higher than the last.

South of Wapiti River the same condition is found, but in a more marked degree; that is to say that each succeeding height of land takes on the form of a definite ridge, with a more noticeable gain in altitude, until Narraway River is reached at the southerly end of township 62.

From Narraway River the line rises 2200 feet in less than a mile of distance to the summit of the first, and lowest, outlying ridge of Mt. Torrens, beyond which the country takes on a generally mountainous character throughout.

The main topographical features covered by the 1922 survey are Wapiti and Narraway Rivers and Mt. Torrens.

Wapiti River runs in a general north-easterly direction for a considerable distance on either side of the Boundary, which it crosses in township 66.

Narraway River runs in a general due east direction across the Boundary in township 62 and then swings to the north, and slightly west of north, to its confluence with the Wapiti River in township 66 which occurs five and a half miles downstream from the Boundary, although only three miles due east from it. Narraway River is the right branch of the main Wapiti River. Above the forks the two rivers appear to be about equal in size.

Both the above rivers present very similar characteristics, being swift of current and occupying deep and narrow valleys with steep banks from 500 to 900 feet high. From the relative width of gravel beds and general appearance of the two rivers, it seems probable that the Wapiti carries more water than Narraway River during the spring run-off. On the other hand, during the first week in August, in which the party crossed both rivers, there appeared to be more water in Narraway River than in the Wapiti, the reason probably being that Narraway River derives a larger proportion of its flow from glaciers than the Wapiti.

Owing to the character of their valleys, both rivers present formidable obstacles to any kind of horse transportation, even to that most primitive of all kinds, the pack-horse.

The Wapiti was crossed on Calahoo trail which plunges off the plateau on the north side of the river and descends 495 feet by a series of short cut banks, ridges and mud-slides, some of which are on a slope of 30 degrees. The ascent of about 750 feet on the south side is even harder on horses, because it is a more continuous climb and affords fewer standing places.

South of Wapiti River there is only one trail deserving the name in the vicinity of the Boundary, and that is the survey trail cut by the party. Calahoo trail, which is shown on several maps issued by the Department of the Interior, is merely a hunting trail used, as explained to Mr. Cautley by one of his party, in the early spring and late autumn when the muskegs are frozen. In summer the trail is so bad that it was found impossible to use a part, and those portions of it which follow high ground are obstructed by windfallen timber.

The survey trail across Narraway River was found, after considerable difficulty, about one and a half miles west of the Boundary crossing. It is fairly good except for an unavoidable drop of 150 feet down a very steep, rocky chute on the north bank of the river.

Mt. Torrens is the first mountain encountered on the 120th meridian from the north. Its altitude above sea-level is only 7239 feet, but it covers a large area, consisting of an S-shaped ridge six miles long with a number of small peaks along it connected by low saddles. As the summit is approached from either side each peak passed is a little higher than the preceding one. Mt. Torrens rises 4100 feet above the main stream of Narraway River which flows along its northerly base.

SEASON OF 1923

FIELD WORK

In pursuance of the policy adopted by the Conference of October, 1921, as described in Chapter II, the work projected for Mr. Cautley's division during the season of 1923 consisted in the production of the 120th meridian as far north



FORDING NARRAWAY RIVER

as the length of season might permit from Monument 84-5, which had been established by him in 1919 as the most northerly point of the survey. Monument 84-5 is near the north boundary of township 84 and about twelve miles north of where the Boundary crosses Peace River.

In considering the extension of the 120th meridian north, it was decided to abandon the construction of concrete monuments to mark the Boundary

and to use only the secondary type of monument authorized by the 1921 Conference. This change was made owing to the greatly increased cost and difficulty of transporting cement so far from the party's base of supplies, and also because it was anticipated that it would be difficult to find suitable supplies of gravel within reasonable distance of the work. That the change was well-advised is proven by the fact that only one, poor source of gravel supply was discovered



CAIRN ON THE SUMMIT OF MT. TORRENS

between Peace and Doig Rivers, a distance of 54 miles, so that it would have been impracticable to build concrete monuments in any case.

Mr. Cautley's party consisted of himself, his assistant, Mr. A. O. Gorman, D.L.S., Mr. G. Palsen as leveller and seventeen men with a pack-train of thirty-one horses.

The party was organized at Edmonton and left on the 17th May for Peace River, from which point it proceeded up the river on the Hudson's Bay Company's motor boat "Weenusk" and reached the Boundary on the 21st May, where it was met by the packers and pack-train.

From Peace River to Boundary Landing about three miles downstream from the actual crossing of the Boundary, the distance closely approximates 150 miles, and the "Weenusk" made it in 44 hours of actual running time, pushing a barge 76 feet long, 13 feet in beam and drawing three feet of water when loaded, as on this occasion—with thirty tons of freight. Coming downstream, when returning on the 10th September, the same distance was made in 13 hours of running time.

The present cost of handling freight on Peace River is excessive, amounting roughly to \$20 per ton per 100 miles upstream, and \$10 per ton per 100 miles downstream. The reasons for the high cost are: the limited and uncertain quantity of freight offered for shipment and the consequent tendency to use small motor boats and barges, which are very much more costly to operate in proportion to their carrying capacity than larger and more efficient wood-burning steamboats. The danger to the propeller from gravel bars and driftwood makes it necessary to build gasboats so that the propeller revolves in a "tunnel," which results in a loss of from 25 to 35 per cent of the power generated.

From the Boundary landing the party proceeded by the survey trail of 1919, to Boundary Lake, a distance of about eighteen miles, and, on the 28th May, having completed the survey of the lake, began work on the extension of the Boundary.

From the 28th May to the 28th August the survey progressed steadily north a distance of $77\frac{1}{2}$ miles, the last monument built being No. 97-5 which occurs on the summit of a high ridge and overlooks toward the south nearly 50 miles of the low, flat country through which the survey passes. The above ridge is an easterly spur of a main ridge which lies in a general northeasterly and south-westerly direction and probably forms the watershed between Fort Nelson and Hay Rivers.

On the 29th August the party turned back and arrived at Peace River on the 10th September, proceeding thence to Edmonton where they were paid off on the 12th September.

In the meantime, the horses had been swum across Peace River at the Boundary and taken by the packers down to Rio Grande, where Mr. Cautley went from Peace River to arrange for wintering them and to pay off the packers subsequently arriving in Edmonton on the 15th September.

During the season 77.5 miles of line were cut out and chained by precise methods; 70 monuments of the new-style standard post type, with mound and trench, were established; the whole line was levelled and check-levelled, and surveyed connection was made with the 22nd and 23rd Base Lines respectively. In addition, detailed topographic exploration work was carried on for one and a half miles on either side of the Boundary.

GENERAL DESCRIPTION OF COUNTRY

In the whole distance surveyed in 1923 there are only three important topographical features to be noted, namely Clear Hills and Doig and Chinchaga Rivers.

Clear Hills are an extensive system of long ridges which lie in a general east-northeast and west-southwest direction, and attain a maximum altitude of about 3600 feet (or 2350 feet above the water level of Peace River). The Boundary crosses Clear Hills near the middle of township 88 at an altitude of 3300 feet, just passing over the westerly extremity of the main ridge, where it breaks away towards the west and loses its identity.

Doig River which is the main tributary of Beaton River crosses the Boundary near the north boundary of township 91, flowing in a general westerly direction.

Near the Boundary, Doig River has an average width of 65 feet and is from eighteen to thirty inches deep with a sluggish current of less than half a mile per hour. On the 23rd July—when the water was at a very low stage—the flow was estimated at 44 cubic feet per second, but one week later—after the heaviest rains of the season—the packers reported that the river had risen five feet and that the horses had to swim to get across it. The water is very warm and is tawny but good.

Doig River drains a vast muskeg country; the valley at the Boundary is 75 feet deep and it is characteristic of the country that within twenty feet of the top of the banks the surface stretches away in wet muskegs for miles.

Chinchaga River, a southerly tributary of Hay River, crosses the Boundary in a general easterly direction two miles north of the south boundary of township 96.

At the Boundary, the Chinchaga is about 60 feet wide and 24 inches deep, and the current varies from half a mile to one and a half miles per hour. On the 21st August the flow was estimated to be 133 cubic feet per second¹.

The river flows in a valley about 45 feet deep, and meanders in long loops and bends to such an extent that every mile in direct distance probably represents three of the channel. Like the Doig, Chinchaga River drains a large muskeg area and the water is tea-coloured but good. There are occasional riffles but as a rule the channel is full of water from bank to bank.

The dominating characteristic of the whole country traversed in 1923 is muskeg. Comparatively high ridges are generally visible on the sky-line and form local watersheds between the various drainage areas of the plateau, but these ridges are many miles apart and the intervening country is extraordinarily flat. So flat is it that although the surface is by no means *level*—and indeed varies considerably in elevation—the drainage is sluggish and indirect to such an extent that the land has become saturated with water and, in the course of

¹ It will be understood that any single estimation of flow is of no value in determining the relative size of streams; for instance, from the estimations made in the cases of the Doig and from Chinchaga it might appear that the Chinchaga carries three times as much water as the Doig, whereas these two rivers are so similar in size and character that it is impossible to say which carries the most water. R.W.C.

many centuries, has developed a sphagnum moss character which constitutes the essential difference between muskeg and any kind of soil. It is probable that the depth of moss superimposed on the soil beneath is not very great, and, in view of the marked difference of elevation shown by the levels, it is certain that enormous areas of muskeg could be easily drained. Usually the muskeg surface alternates with low ridges that emerge a few feet above the general level of the surrounding land and are covered with jackpine.

Owing to the muskeg character of the country, some difficulty was experienced in connection with horse transport. For instance, in townships 90 and 91 the Boundary crosses continuous muskeg for a distance of ten miles without



MONUMENT 88-3 ON SUMMIT OF CLEAR HILLS

once touching solid ground; moreover the muskeg extends unbroken for miles on either side of the line. In this case it was necessary to organize some of the party as a man-packing outfit, and to send the rest about twenty miles around by an old Indian trail which strikes Doig River five miles east of the Boundary. After reaching the Doig, the pack outfit had to cut a trail down the river and made connection with the line party after the latter had spent four nights out in the muskeg.

There are a number of Indian trails through the country, most of which seem to be of ancient origin—certainly long before the advent of white men. As a rule Indian trails proceed very directly between their objective points but the trails in this district are necessarily very indirect because, generally speaking, the only possible location for a summer trail is right along a creek or river; hence it frequently happens that a trail will follow one creek north-east for several miles and then follow another due west in order to reach a desired point.

Most fortunately for the success of the season's work, a tributary of Doig River, which Mr. Cautley named Adskwatim¹ Creek, closely parallels the Boundary for almost the entire distance of 26 miles between Doig and Chin-chaga Rivers, and there is a fairly good Indian trail following it which served the purposes of the survey admirably. For miles on either side of the Boundary the surface between the two rivers is so largely composed of muskeg that it is doubtful if another trail could have been found close enough to the work to be of any service as far as the horses were concerned.

Along the narrow creek valleys and on some of the higher ridges there is a limited quantity of good spruce timber from 18 to 24 inches diameter of good,



DOIG RIVER LOOKING UPSTREAM FROM BOUNDARY

marketable quality if it were at all practicable to get it to market, but it does not occur in sufficiently large bodies to justify building logging railways or caterpillar tractor roads which would be the only way of getting it out at the present time.

Bush fires have occurred in many places, but the marshy nature of the country tends to confine fire within comparatively small areas.

On the whole the season of 1923 was wetter than usual. Rain fell on nine days in June, twenty days in July and eighteen days in August. The party lost 0.2 days in June, 6.0 days in July and 1.5 days in August, or 7.7 days altogether.

¹ Adskwatim, pronounced Ad'-sqoot'-tim', is Cree Indian for "Many dams" and has reference to the many beaver dams found on the creek itself and most of its tributaries. The name has been approved by the Geographic Board of Canada.

Fewer animals of all kinds were seen than usual, because so much of the country passed through was muskeg and extensive muskeg areas do not support much animal life. On the other hand, bears, moose, deer and beaver were plentiful in the river valleys and—beaver excepted—on the higher ridges.



CHINCHAGA RIVER LOOKING DOWNSTREAM NEAR BOUNDARY

It is a curious fact that there should be grizzly bear in such a country but, although none of these animals were seen by the party, several have been killed within the past two years and the party came across two sets of quite unmistakable tracks. At a number of places along the trails these brutes had completely bitten through small jackpine trees, three and four inches in diameter, at a height of seven feet above the ground.

Black bears were very numerous and were a great nuisance. Three of the party's supposedly bear-proof caches, built on stages nine feet above the ground, were raided and a certain amount of loss sustained, but, worse than that, it was noticed on the way back that a great many of the carefully built mounds at monuments had been partially destroyed and tumbled into the trenches. It was noticeable that all the mounds composed of black earth seemed to have been attacked, while those which occurred on sandy ridges had not been touched.

One of the periodic epidemics which kill off the rabbits occurred during the previous winter and there were millions of little white-coated corpses scattered all over the country. It is curious that although dead rabbits were so frequent as to occur at intervals of not more than fifty feet—sometimes for miles at a time—no two bodies were ever seen lying close together.

North of Doig River there are numerous colonies of beavers on almost every creek; the Chinchaga itself was dammed in several places.

There are a number of trap lines all through the territory traversed, and it is said to be a good trapping country for beaver, muskrat, lynx and marten, but that there are few foxes.

Apart from possible discoveries of mineral, the only valuable natural resources of the vast territory of which the land covered by this season's survey is only a fractional part are: first, a potential, deferred value as a timber reserve of poor quality (poor, because 75% of the country is muskeg on which valuable timber does not grow) and, second, a present and immediate value as a first class fur reserve.

The Governments under which the Commission to delimit the Interprovincial Boundary was appointed have definitely decided not to carry on the survey of the 120th meridian to the north boundary of the Provinces at the 60th Parallel of Latitude—at least not under the present Commission—partly because there is no immediate necessity for doing so, and partly, no doubt, because there is no apparent reason why a mathematically exact survey, which calls for no power of discretionary judgment on the part of the surveyor in charge, should be made by a specially appointed Commission. When the time comes, however, as it undoubtedly will, when it is decided to go on with the work, the question will arise as to the best method to pursue in view of what is known of the country.

From Monument 97-5 at the north extremity of the Boundary surveyed this season it is about 174 miles to the 60th parallel of latitude.

Assuming as probable, although by no means assured, that the general character of the country ahead is very similar to that already met with, it is Mr. Cautley's opinion that it would be unsafe to rely on being able to use horse transport throughout, but that the party should be organized as a man-packing outfit with an auxiliary packtrain for the first season's work; that the Boundary should be carried as far as possible in the first season but, in any case, to its intersection with Hay River, which is supposed to be about 85 miles north of the present end of line; that the final season's work might be organized as

a winter survey, with dog-train transport, from Fort Vermilion, the party going down on the last boat of one season and returning on the first boat of the following season.

SEASON OF 1924

FIELD WORK

In accordance with the arrangements made at the Conference of January, 1924, the work of Mr. Cautley's division for the season of 1924 consisted of three separate undertakings: the completion of the 120th meridian surveys to the summit of the Rocky Mountains, the completion of the survey of Phillipps Pass at Crowsnest, and the survey of Robson, Sheep and Miette Passes, in order of importance as named.

Of the above only the first has to do with the survey of the 120th meridian, and is therefore included in Part III-B of the Report, and the other two are reported in Part III-A.

Mr. Cautley's party consisted of himself, Mr. A. O. Gorman, D.L.S., and eight men. It was organized at Edmonton and left that point on the 5th June. On the 7th June it reached Rio Grande—46 miles west of Grande Prairie—where the packers and packtrain of 26 horses were awaiting it.

From the 8th to the 21st June the party was engaged in travelling and transporting supplies 84 miles, from Rio Grande to a camp on Saxon Creek—south of Mt. Torrens—from which work was commenced. The outfit and supplies moved weighed 8,000 pounds, or two complete loads for each pack-horse. Considerable difficulty and some delay were experienced in crossing Wapiti and Narraway Rivers, both of which were very high, but no loss occurred.

From the 22nd June to the 14th August, the party was engaged in producing the 120th meridian south from Monument 61-4 on Mt. Torrens, being the most southerly monument established in 1922, to Monument 56-0 at the intersection of the meridian with the summit of the Rocky Mountains, a distance of 33.9 miles.

The foregoing work involved two distinct but interrelated operations. First, the surveying and monumenting of the 120th meridian itself as a straight-line boundary. Second, the projection of a triangulation net to provide a control system for the calculation of distances along the Boundary.

SURVEY OF 120TH MERIDIAN

The survey of any straight line through really mountainous country is a most unusual proceeding, and involves considerable difficulty. [There are many mountain areas in the Rockies which are so rugged in character that of all the infinite number of potential straight lines which might be laid down only an insignificant number could, in fact, be surveyed at all.] Fortunately, the mountains along the 120th meridian are, for the most part, of a secondary character and presented no insuperable difficulties.

Starting at Monument 61-4, the line was projected southerly to the next sharply defined mountain ridge that commanded a clear view along the meridian in both directions, and, thenceforward, from ridge to ridge.

Monuments consisting of specially marked bolts cemented in rock, over which were erected well-built cairns containing from three and a half to seven tons of rock, were established on all the dominant ridges occupied as stations. The distance between monuments averaged rather over two miles, and varied from half a mile to (in one extreme case only) six miles. Altogether fifteen monuments were established in a total distance of 33.9 miles, of which all except two are of the Bolt and Cairn type. The two exceptions referred to occurred in alpine meadows and are of the standard post type, with earth mound and trench. With the exception of two monuments, established in the valleys of Kakwa, and Sheep Creek respectively, all the monuments in this section range in altitude from 6,000 to 8,000 feet above sea-level, and are well above timber line. With the single exception of Monument 56-0, every monument is intervisible with the adjacent monument on either side of it.

There is a good deal of timber in the valleys between monumented ridges, but, in accordance with the decision of the 1924 Conference, the line was not opened out, except only in the Kakwa and Sheep Valleys, where a certain amount of line was cut as a means towards finding the monuments established in these valleys.

The greatest difficulty experienced in projecting the 120th meridian was due to the fact that most of the stations were so high above the valleys, and involved so much hard climbing, that it was found impracticable to use the large transit for producing, and that the lighter transits, while excellent angle-reading instruments, proved insufficient for first-class line production. For the above cause it was found necessary to observe for azimuth as often as possible, and to depend on astronomic control for the correction of the line from time to time.

TRIANGULATION SURVEY

The triangulation net was started from the base measured between Monuments 62-3 and 62-6 on the meridian itself, surveyed by Mr. Cautley in 1922, which was found to be 252.662 chains in length.

From the above base the net was gradually expanded until the sides of the triangles were about seven miles in length.

Finally the net was closed on a triangulation base in the valley of Sheep Creek, surveyed in August, 1924, by Mr. F. A. McDiarmid of the Geodetic Survey of Canada.

Sheep Creek base is just over three miles in length, and was measured by the most precise methods known to the profession of surveying. The chain used was of the iso-bar type; it was supported at regular intervals of its length, and the variations in elevation of all the chain-end stations were ascertained by carefully checked levels. The extremities of the base are marked by bolts set in concrete.

Mr. McDiarmid also established the latitude and longitude of the easterly extremity of the base by a series of precise astronomical observations of the kind described on page . . of Part III-B of the Commissioners' Report.

In regard to the longitude observations obtained by Mr. McDiarmid, it is interesting to note the revolution that has taken place in the practice of astronomical determination of longitude since Mr. McDiarmid established the longitude pier at Pouce-Coupé in 1917. At that time it was impossible to make an astronomical determination of longitude, with anything approaching the degree of precision required for the establishment of an interprovincial boundary, at any place that was not directly connected by an ordinary telegraph line with some point of previously determined longitude. In 1924, owing to the development of radio-telegraphy, it was possible to make such a determination at any point whatsoever, leaving out of consideration what are known as "dead" areas. It would be difficult to exaggerate the immense importance of radio-telegraphy to those who undertake the mapping of unexplored parts of the world. In the case of the Sheep Creek determinations, telegraphic time signals were received direct from Annapolis, U.S.A., and were very clear.

Mr. McDiarmid's results for the position of monument 56-2, established at the exact intersection of the 120th meridian, with McDiarmid's base line, were accepted, the closing errors indicated being as follows:—

Length of Sheep Creek base as determined by F. A. McDiarmid . .	240.391 chains	
Length of Sheep Creek base, calculated from Commission's triangulation, after applying corrections for temperature, and difference in mean elevation above sea-level of Cautley and McDiarmid bases.....	240.393	"
Difference.....	0.002	"
Latitude of Monument 56-2, referred to F. A. McDiarmid's Sheep Creek observations.....	53° 50' 05"32	
Latitude of Monument 56-2, by account of Boundary survey, based on latitude of F. A. McDiarmid's pier at Pouce Coupé—131 miles north—and the latitude value of the intervening distance reduced to a sea-level basis.....	53° 50' 07"23	
Longitude of Monument 56-2, referred to F. A. McDiarmid's Sheep Creek observations.....	120° 00' 00"31	
Longitude of Monument 56-2, by account of Boundary survey, based on the Pouce Coupé longitude determination.....	120° 00' 00"00	

The latitudes established by Mr. McDiarmid at Pouce-Coupé and at Sheep Creek piers are astronomical, and are therefore subject to any deviation of the normal which may exist at either or at both of these stations. As purely astronomic determinations frequently differ from those derived by Geodetic methods by several seconds of arc, the above closings must be regarded as entirely satisfactory.

Ordinarily, in laying out a system of triangulation, it is only necessary to choose stations which will be intervisible and will be suitable points of a system that conforms to the predetermined requirements of the survey. In this case it was necessary to select stations that would not only be intervisible with other stations of the system, but also, as far as possible, would be intervisible with the monuments established along the 120th meridian. In several cases it was not found possible to find such stations, and it became necessary to make use of subsidiary stations and triangles in order to connect the main control stations with the monuments.

South of Kakwa River, a Geodetic survey party under Mr. F. H. Lambart had established cairns during the season of 1923 on a continuation of their triangulation net from the south, and much time and labour was saved to Mr. Cautley's party by the use of these.

CONNECTION WITH 16TH BASE LINE

The 16th base line was the only previously surveyed line with which connection was made during the season of 1924. It had been surveyed by George McMillan, D.L.S., in 1910 to a point about four miles east of the 120th meridian. A surveyed connection was made between it and the Boundary by subsidiary triangulation.

TRIGONOMETRICAL LEVELLING

Altitudes above sea-level of all monuments on the 120th meridian in the mountain section, and of all the mountains occupied as stations of the triangulation net, have been derived from the line of precise levels along Fort St. John road. Carefully checked spirit levels were carried from Fort St. John line as far as Wapiti River, a distance of 51 miles. South from Wapiti River to the intersection of the meridian with the summit, a distance of 65 miles, reciprocal trigonometrical levelling was employed.

During the years that Mr. Cautley's division was engaged in carrying levels 116 miles south, from Fort St. John datum to the intersection, Mr. Wheeler's division was carrying trigonometrical levels north from Yellowhead Pass railway datum to the same point, a distance of about 130 miles over very rough mountains. Where the work of the two divisions was joined up, namely at the intersection of the 120th meridian with the summit of the Rockies, there was a difference of twelve feet between them, Mr. Wheeler's altitude being that much in excess of Mr. Cautley's.

GENERAL DESCRIPTION OF COUNTRY

The intersection of the 120th meridian with the summit of the Rocky Mountains occurs on the edge of a precipitous escarpment forming the northerly face of Intersection Mountain. Intersection Mountain is a long, knife-edge

ridge overlooking Sheep Creek valley to the north, and Bolt 56-0, which marks the actual intersection, is within 70 feet of its highest point and has an altitude of 8044 feet.

Monument 56-0 marks a spot which is shown on every atlas of Canada, and which your Commissioners have been striving towards for years. It is a matter for regret that, in spite of what would seem from the above description to be a very commanding position, Monument 56-0 is really very inconspicuous. This is largely due to the fact that the ridge of Intersection Mountain lies nearly north and south, with various lateral ledges which cut off the view from any point in Sheep Creek valley that is near the boundary.

Reproductions of photographs of the cairn over Bolt 56-0, and of other monument cairns, will be found in the Appendix.

In the following descriptions all distances given are those north along the meridian from Monument 56-0.

Sheep Creek valley is two and a half miles north of Monument 56-0. It is a wide, open, grassy valley, lying nearly east and west, with low, timbered hills leading back to the foot of the mountains on either side. The creek that meanders through it is a mere rivulet at the Boundary. The altitude of Monument 56-2, which is within ten feet of water level in the creek, is 5262 feet.

Sheep Pass, which was thought to lie east of the 120th meridian, and therefore to be a pass on the mountain section of the boundary, was found to be about one and three quarters miles west of the meridian and is entirely within the Province of British Columbia. The wide, grassy valley of Sheep Creek gradually narrows as it approaches the summit of the pass, and the summit itself is not very well defined, being a broken timbered ridge on the west side of a lake with three small streams flowing into it but no surface outlet.

Five miles north of Monument 56-0 and one mile west of the Boundary there is a high pass between the headwaters of Sheep Creek and Kakwa River, over which an old hunting trail passes.

There are some fine mountains around the head of the above pass and along the west side of Kakwa River, which latter flows nearly due north for fifteen miles.

From Sheep Pass, proceeding northerly, the Boundary passes nearly over the summit of Mt. Cote, at six miles. Thence it traverses the east slopes of a ridge dividing Kakwa River from a tributary of Sheep Creek to Monument 57-2 (altitude 6806) at eight and a half miles. Thence it descends into the valley of Kakwa River opposite Cecilia Lake, approaching within a few chains of the most easterly point of the latter at about twelve miles. Thence it rises over some beautiful and extensive alpine meadows to a point high up on the westerly shoulder of Mt. Minnes at nineteen and a quarter miles.

Kakwa is an isolated mountain (altitude 7531) around whose west and north slopes Kakwa River bends to the east. From it there is a clear view up the lesser fork of Kakwa River to Jarvis Pass, which is about six and a half miles slightly north of west from Mt. Minnes, and, across the wide, irregular

flats of the Kakwa to the outspread bulk of Mount Gorman. Kakwa River crosses the Boundary close under the foot of Mt. Minnes and has an altitude of 4500 feet. Kakwa flats, in the vicinity of the Boundary, are about three and a half miles wide, and show many signs of glacial action in the many drifts of debris left in the wake of slow-moving glaciers. The flats are mostly timbered, with many grass marshes, and have an uneven surface varying 300 feet in altitude.

Leaving Kakwa flats at mile $23\frac{3}{4}$, the meridian climbs 2000 feet to Monument 60-S, which is on the most southerly of various outlying ridges that proceed from Mount Gorman.

Half a mile west of Monument 60-S, there is a high pass between head waters of Kakwa and Torrens Rivers, over which the Boundary survey trail is located.

At Mile $26\frac{1}{4}$ Monument 60-1 is erected on the summit ridge of Mt. Gorman (altitude 7800), at a point about 5.00 chains east of the summit. Mt. Gorman seems to be higher than any of the mountains to the east or north, although there are much higher mountains to the west and south. It covers a great stretch of territory, being one of those mountains which radiate ridges four or five miles long.

At about Mile 29 the meridian crosses Torrens River, which is sixty feet wide with a very swift current two and a half feet deep. Torrens River swings around the easterly slopes of Mt. Torrens and joins Narraway River, of which it is the left fork, about six miles north of Mt. Torrens.

Monument 60-3 (altitude 6135) is built at mile $30\frac{1}{2}$ on the summit of a lumpish ridge between Torrens River and Saxon Creek.

At Mile 32 the meridian crosses a very marshy valley just at the summit between the head waters of Saxon Creek and a small tributary of Torrens River. Saxon Creek flows west and north around the foot of Mt. Torrens and empties into Narraway River a few chains west of where the meridian crosses it.

At Mile 34 the meridian is marked by monument 61-4 (altitude 6550) which is on a bold ridge leading directly to the summit of Mt. Torrens, about 30.00 chains easterly.

At Mile $36\frac{3}{4}$ Monument 62-1 is established on Dinosaur Ridge which forms the northerly extremity of the long, serpentine range that, with many small peaks and saddles, is Mt. Torrens.

Monument 62-1 is the last distinctively mountain monument. North from Dinosaur Ridge, the surface falls 2200 feet in less than a mile of distance to Narraway River, and north of Narraway River the country is entirely different.

Besides Mt. Sir Alexander and Mt. Ida, which are at least known by name, although so little known that your Commissioners' surveys have discovered them to be ten miles out of true position on all existing maps, there are many grand mountains, that will some day be famous, in the main range to the west of the line surveyed in 1924. The mountains along the 120th meridian, however, are of the smooth-topped, rounded variety, with much soil on the surface

as a rule, which bears witness to the grinding-down and wearing-off action of immense glaciers.

There are very beautiful alpine meadows scattered through the country and abundant feed.

About thirty-five years ago—to judge by the apparent age of the wind-fallen brûlé—all the well-worn hunting trails from the north into this region were so effectively blocked by forest fires of great magnitude and extent that none of them has ever been reopened. A few solitary trappers have followed their precarious calling up the rivers and creeks in winter, but there has been no summer trail of any kind whatsoever until the requirements of the boundary survey made it necessary to locate and cut out the present survey trail. There is a rough hunting trail from the south as far as Cecilia Lake, sixteen miles north of Monument 56-0 and a mile west of the Boundary, but only a few of the more adventurous hunting parties ever got north of Sheep Creek. One result is the existence of a splendid game reserve, with ideal conditions of feed and range, that has been inviolate for several generations of animal life. It was a rare occurrence for any climbing party to return to camp without having sighted game during the day. Mountain sheep, goats, moose, caribou and deer are not only plentiful but very tame. Caribou, crossing a valley up which Mr. Cautley's packtrain was travelling, passed right through the strung-out horses. On another occasion, a big caribou bull came within 150 feet of a camp fire with four men and six horses around it, and grunted at them for several minutes. On La Creche Mountain, Mr. Cautley reports having counted 70 goats, all nannies and kids, and, on the same day, moose, caribou and deer were seen. Only one grizzly bear was encountered—at Cecilia Lake—and there were very few black bears in the country. Porcupines and hoary marmots were very numerous and a great nuisance. On several occasions porcupines were met with 500 feet above timber line, on bare mountain sides.

Most of the valleys and hillsides are thickly timbered, but, owing to the altitude, its sub-alpine character makes it of no commercial value.

CHAPTER IV

DESCRIPTION BY TOWNSHIPS OF COUNTRY TRAVERSED BY THE BOUNDARY

The intersection of the 120th meridian with the summit of the Rocky Mountains occurs about a quarter of a mile south of the north boundary of township 55 in the Dominion Lands System of survey.

For thirty-six miles north from the above point, through Townships 56 to 61 inclusive, the meridian traverses a purely mountain area, which terminates abruptly at Narraway River.

A general description of the country through the above mountain townships will be found in Chapter III, pages 127 to 130, but it is not considered necessary to describe it in detail.

TOWNSHIP 62

The south boundary of township 62 crosses the most northerly end of the main ridge of Mt. Torrens, which has been named Dinosaur Ridge. The ridge definitely marks the end of the mountainous country, and, when viewed from the north along the meridian, presents a high barrier visible from points north of Wapiti River. Monument 62-1 was built on the sharply defined summit of Dinosaur Ridge, and is about eleven chains north of the south boundary of the township. The ridge continues about a quarter of a mile northwesterly from Monument 62-1, and then falls steeply into the valley of Saxon Creek. The northerly slopes of Dinosaur Ridge fall sharply to Narraway River, which flows at its foot from west to east, less than a mile from the summit and 2200 feet below it.

About fifteen chains west of the Boundary Saxon Creek enters Narraway River through a picturesque rock canyon.

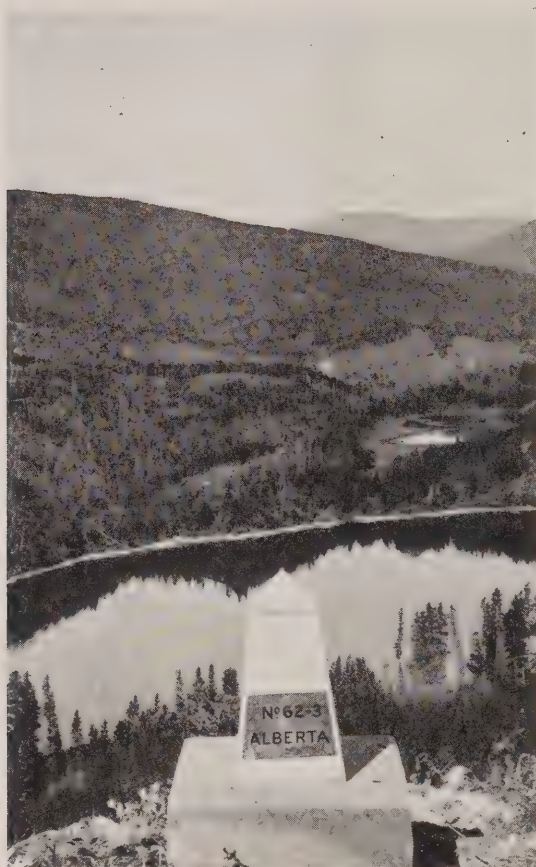
About fifty chains north of Narraway River, and 525 feet above it, the first concrete monument was built (No. 62-3) and marks the end of the triangulation survey which extends from the intersection of the 120th meridian with the summit to said monument.

The measured base of the triangulation survey extends from concrete Monument 62-3 to concrete Monument 62-6—a distance of 252.662 chains. The apex of the first triangle is at Station A on the summit of Omega Hill, which is about four miles north and two miles west of the intersection of the Boundary with the south boundary of township 62. The apex of the second triangle is at Station D near the southerly end of Saxon Ridge, being about half a mile north and two and a quarter miles west of the said intersection.

Omega Hill has an altitude of 6027 feet, and the name was suggested by the thought that it is probably higher above sea-level than any other point of

land between it and the North Pole. Looking north from the summit on a clear day, the visible horizon is so very far away as to appear a mere blurred shadow.

In the above photograph the summit of the sky-line mountain which fills the valley of Narraway River is astronomically due west from Monument 62-3,



MOST SOUTHERLY CONCRETE MONUMENT

which can be seen on the rocky point in the centre foreground. The mountain referred to is roughly estimated to be fourteen miles distant.

On the north boundary of section 23 in this township a creek about sixteen feet wide crosses the Boundary in an east-southeasterly direction, and was named Flume Creek. It is a small mountain torrent, in a narrow canyon from 400 to 700 feet deep, which enters Narraway River about two miles east of the Boundary. Flume Creek circles around the northerly base of Omega Hill, and drains a considerable mountain area to the west of it.

The surface of the country in the vicinity of the line across township 62 is rough and covered with brûlé and scrub timber. There is no valuable timber on line, but there are about 400 acres of good spruce timber—up to twenty inches in diameter—between the Boundary and Omega Hill.

No old trails were noted. The country is difficult to get through for small hunting parties with horses, on account of its roughness and the amount of



LINE LOOKING NORTH ACROSS THE WAPITI RIVER

wind-fallen timber. Few old axe-cuttings were seen, and these had been made by occasional trappers who come up on Narraway River in winter. The survey trail lies almost altogether to the west of line, and is fairly good with the exception of one bad place, previously mentioned as being on the north bank of Narraway River. Between Monuments 62-3 and 62-4, and about a quarter of a mile east of line and also on the bare hills which form the northern banks of Narraway

River, are two small lakes where there is good horse feed. There is also good feed about two miles up Saxon Creek and on the high slopes of Omega Hill.

Seven Monuments were built in township 62, of which Numbers 62-3 and 62-6 are concrete monuments and the remaining five are of the secondary type.

TOWNSHIP 63

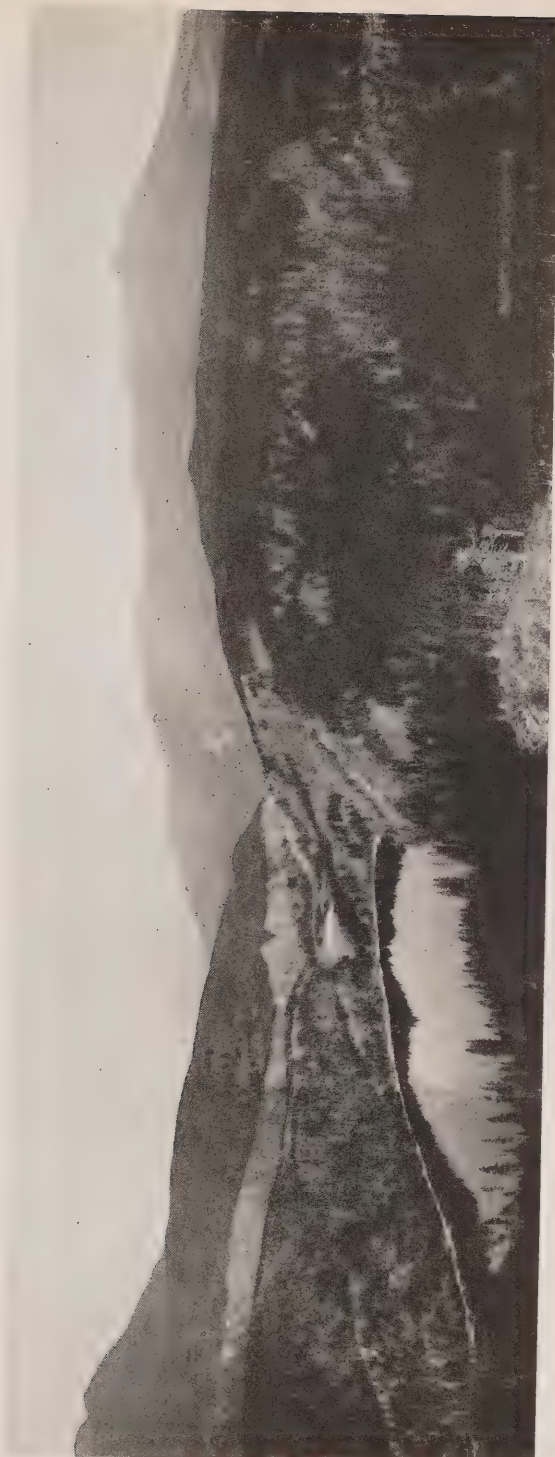
The Boundary crosses the south boundary of township 63 exact'y on the low ridge which forms the watershed between Narraway and Wapiti Rivers, at an elevation of 1200 feet above the former. The above ridge continues east, and then east-northeast and west-northwest until it is again crossed by the Boundary, nearly four and a half miles north of the south boundary of the township, and continues northwesterly as the local watershed between Huguenot and Mistanusk Creeks, both of which, however, are tributaries of the Wapiti. From an altitude of 4430 feet at its intersection with the south boundary of the township, the ridge rises to a maximum altitude of 5800 feet about two miles northeast of that point and crosses the Boundary the second time at 5192 feet (Monument 63-6), rising again to 5379 feet at Compass hill, beyond which it speedily falls below the 5000 foot contour. Compass hill is five and a quarter miles north of the south boundary of township 63 and three-quarters of a mile west of the Boundary. It is a flattish, conical point of the main ridge, sufficiently higher than the rest of it to make a noticeable landmark for many miles. From Compass hill a well defined spur of the main ridge extends east and crosses the Boundary at Monument 63-7.

For nearly four and a half miles, as far as Monument 63-6 on the second crossing of the above ridge, the line traverses many small creeks, and broken ridges, forming the headwaters of Huguenot Creek.

Huguenot Creek is a sluggish stream flowing north-northwesterly through a wide series of beaver meadows and muskegs. Even at a distance of five miles from its headwaters, at the intersection of the Boundary with the south boundary of township 63, Huguenot Creek is only about ten feet wide and two feet deep with a current of half a mile per hour. During the spring run-off it doubtless floods the flat, marshy valley through which it flows. Huguenot Creek is the lesser branch of a more important stream, named Belcourt Creek, which flows northerly and enters Wapiti River about five miles upstream from the Boundary.

Between Monuments 63-6 and 63-7 the Boundary crosses a horse-shoe-like basin, of which Compass hill is the apex and the little creek in its bottom is one of the headwaters of Mistanusk Creek.

Belcourt Creek, Huguenot Creek, Mistanusk (Cree Indian for badger) Creek and Compass hill, are all names suggested by the Commission and approved by the Geographic Board of Canada. Belcourt was a particularly useful half-breed member of the party who had trapped on Mistanusk and Belcourt Creeks, which slender claim to fame constitutes all the historical interest that attaches to any of the above names.



VALLEY OF THE NARRAWAY RIVER—PANORAMA

The whole country passed through in township 63 is rough and broken within total limits of variation in altitude along the line of nearly 1000 feet. The surface is covered with scrub timber—mostly jackpine—and a good deal of windfall. No valuable timber was seen.

There are beaver on Huguenot and Belcourt Creeks, and it is a good moose and caribou country.

No old trails were noted. The survey trail closely follows the Boundary for the first mile north; it then follows down Huguenot Creek for about two and a half miles, and turns off, northeasterly, up a steep tributary which heads up into the main ridge, near Monument 63-6; following the main ridge round by Compass hill, it descends a small tributary of Mistanusk Creek which leads north about half a mile west of the Boundary. There is excellent horse-feed along Huguenot Creek; one-night feed for thirty horses near the top of the trail up the tributary, and good feed in the horse-shoe valley between Monuments 63-6 and 63-7, to which a spur trail was cut.

Six monuments were built in township 63, of which Monument 63-7 is of concrete, and the remaining five are of the secondary type. There is no Monument 63-1, it having been discovered too late that the site selected for Monument 63-1 was really in township 62.

TOWNSHIP 64

The ridge on which Monument 63-7 is built, at 28.62 chains south of the north boundary of township 63, overlooks a wide and irregular valley to the north which is drained by the many tributaries of Mistanusk Creek.

It is characteristic of the general formation of the country that each main ridge passed in a northerly direction is considerably higher than any of those ahead. For instance the 63-7 ridge is 510 feet higher than the next main ridge eleven and a half miles further north, on which Monument 65-5 is built at an altitude of 4382 feet. The 65-5 ridge is 900 feet higher than the main ridge on which Monument 67-2 is built—nearly nine miles further north; and, finally, the 67-2 ridge is 180 feet higher than where the Boundary crosses the summit of Clear Hills, 128 miles further north, at an altitude of 3306 feet.

From the summit of the 63-7 ridge, the surface falls 770 feet to the left fork of Mistanusk Creek, which crosses the line in a north-easterly direction nearly one and a half miles north of the south boundary of the township. The Creek then roughly parallels the line at a varying distance which never exceeds one mile and, having more than doubled in size, crosses the Boundary in a north-northwesterly direction nearly five and a half miles above the south boundary of township 64.

Mistanusk Creek is a pretty stream, with clear, good water and clean gravel bottom, flowing through small, grassy flats with excellent horse feed. On the 1st July, 1922, after much dry weather, the rate of discharge at the Boundary was estimated to be fifteen cubic feet per second, but the wide gravel beds and evidence of driftwood piles prove that there must be a tremendous run-off when

the snow melts. Mistanusk Creek enters Wapiti River about four miles upstream from the Boundary.

After the descent from the 63-7 ridge to the first crossing of Mistanusk Creek, the line passes over a rolling surface with an irregular fall towards the creek. To the west, the surface is much higher than along the line, extending as spur ridges from the main bridge between Huguenot and Mistanusk Creeks. East of the line, and not more than two miles from it, there is a low ridge forming the watershed between Mistanusk Creek and Narraway River. Numerous marshes and muskegs occur in the lower part of the Mistanusk valley.

The surface is covered for the most part with small jackpine timber, and there is much heavy brûlé, especially to the west of line on the above-mentioned spurs. No valuable timber was seen.

From the south boundary of township 64, the survey trail follows a north-flowing tributary of Mistanusk Creek—which is about half a mile west of the Boundary—about a mile to its confluence with the left fork; it then follows the left fork across the Boundary, and remains on the east side of the line until the main stream of Mistanusk Creek is reached in section 35, after which it follows the creek downstream. There is good horse feed at various places along the creek from the Boundary downstream, although by far the best horse camp is three-quarters of a mile north of township 64 and 25·00 chains west of the Boundary. No good horse feed was discovered elsewhere in the township.

Survey and level connections were made along the north boundary of section 35 between the Boundary survey and that of the 17th Base Line.

Six monuments were built in township 64, all of which are of the secondary type.

TOWNSHIP 65

In the southerly four and a half miles of township 65 the Boundary ascends obliquely the valley slopes of Mistanusk Creek to the summit of a sharply-defined ridge, which forms the watershed between Mistanusk and Chinook Creeks, and is named Chinook Ridge.

Chinook Ridge crosses the Boundary in a general northwesterly direction, gradually swinging north to the very edge of Wapiti valley, on which it fronts as a notable headland. It is very symmetrical, having a nearly level sky-line, with steep-sided slopes on the north and east, and easy slopes on the reserve sides. About half a mile southeast of where Chinook Ridge is crossed by the Boundary, it breaks away somewhat abruptly and falls about 400 feet, after which it loses its identity in transverse ridges, or spurs, running north-northeast and south respectively. Concrete Monument 65-5 was built on the summit of Chinook Ridge, and has a very commanding outlook both north and south, being 1880 feet above the water-level of Wapiti River.

Chinook Creek is a small stream which drains most of the country lying between Chinook Ridge and the ridge dividing it from Narraway River. It

enters Wapiti River three and three-quarters miles downstream from the Boundary crossing, and about one mile west from the entrance of Narraway River.

About two and a quarter miles north of the south boundary of township 65, the Boundary passes a few chains west of a marshy lake, about forty acres in extent, which drains westerly into Mistanusk Creek. To the east and north-west of the lake there is considerable muskeg and tamarack swamp.

To the south of Chinook Ridge the watershed between Mistanusk Creek and Narraway River follows low, indeterminate ridges, approximately one mile east of the Boundary.

North of Chinook Ridge the surface falls rapidly to the wide basin of Chinook Creek, which is broken up by irregular ridges alternating with small muskegs, and the lowest point of which is just south of the north boundary of the township.

As far north as the above described lake the Boundary runs through small aspen and jackpine. From the lake to the top of Chinook Ridge there are thick woods of jackpine and spruce up to nine inches in diameter, while that part of township 65 lying north of Chinook Ridge is covered with scrub timber and much wind-fallen brûlé on the ridges. No valuable timber was seen in township 65.

The only old trail noticed in township 65 was Calahoo trail which was crossed in the first mile north of the township, and swings east around the easterly end of Chinook Ridge to Chinook Creek. Calahoo trail is an old Indian hunting trail, used in early spring or late autumn when frost is still in the ground. It runs through so much wet muskeg, and is so badly obstructed by wind-fallen timber where it passes over ridges, that it is not a practicable summer route for horse travel. Mr. Cautley was informed that, after crossing Mistanusk Creek west of the line, it proceeds southwesterly over the intervening ridge to Belcourt Creek.

The survey trail is fairly good and, after coming on to the line from the west about a mile north of the township boundary, follows the Boundary closely until near the summit of Chinook Ridge, where it swings to the east over the extreme end of the ridge; thence it returns northwesterly to the line at Monument 65-6, and then turns east-northeast to the main stream of Chinook Creek, where it joins Calahoo trail and follows it for some distance north. The best horse-feed of the season was found in meadows along Mistanusk Creek, at a place three-quarters of a mile north of township 64 and 25.00 chains west of the Boundary, and there is lots of it. The only other fairly good feed is in some marshes to the west of line at the extreme north end of the township, to which a spur trail was cut from the main trail half a mile east.

Seven monuments were built in township 65, of which Nos. 65-1 and 65-5 are concrete monuments, while the remaining five are of the secondary type.

TOWNSHIP 66

For about two and a quarter miles north from the south boundary of township 66, the Boundary runs over the westerly side of a low ridge forming the watershed between Chinook Creek and a small unnamed creek, which enters Wapiti River about a mile west of line, to the abrupt edge of Wapiti River valley, near which Monument 66-2 is situated. The surface is mostly covered with very heavy wind-fallen brûlé interlaced with second-growth jackpine, and drains to the west.

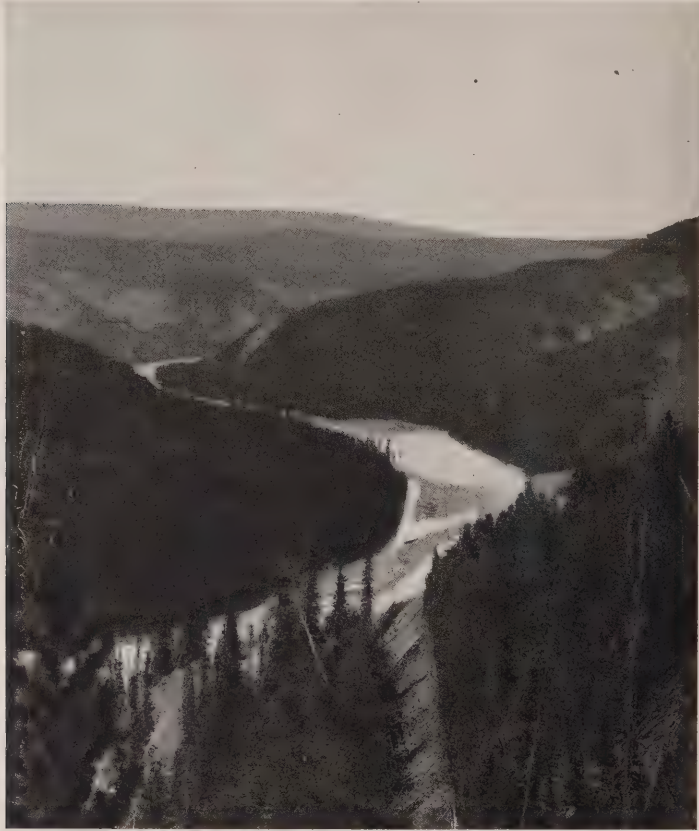
The Boundary strikes Wapiti River on the westerly side of a bold loop to the north (three miles deep on the west side and two miles on the east) in such a way as to cut off the most westerly portion of the loop and make two distinct crossings about one mile apart. From Monument 66-2 the line descends 600 feet, in a distance of 33·50 chains to the water's edge, over a rough and broken terrain of ridges, watercourses and mud-slides. It then passes over the water for a distance of forty-three chains, cutting off a wide bend of the channel and just touching the river bank at the most easterly point of the westerly shore, and later rises 420 feet, in a distance of thirty chains, to the crest of an outlying spur of the main bank, on which Monument 66-3 was built at a point about twenty chains east of the river. From Monument 66-3 the Boundary descends 446 feet, in a distance of forty chains, to the second crossing of the river, at which concrete Monument 66-4 was built. After crossing the river, which is running due north-east at this point, the line ascends 517 feet, in a distance of 34·20 chains, to concrete Monument 66-5, built a little way back from the edge of the steep cut-bank.

At the northerly intersection of the southerly crossing, the water-level of Wapiti River was found to have an altitude above sea-level of 2525 feet, while at the northerly crossing the altitude was found to be 2505 feet at the same stage of water. As the two points are almost exactly one mile apart, a comparison of the two above altitudes indicates a fall per mile of twenty feet.

A careful traverse of Wapiti River was made on the ice in February, 1922, for three and a half miles on either side of the Boundary, from which, and from a prismatic compass and paced extension to the east as far as the confluence of Wapiti and Narraway Rivers, it is known that the forks are nearly five miles downstream from the northerly crossing of the Boundary. It may therefore be assumed that the altitude above sea-level of the Wapiti at the forks is very close to 2400 feet, whereas a similar altitude at the Boundary crossing of Narraway River—near Monument 62-2—was found to be 3212 feet. In a direct line along the Boundary, the distance between the two rivers is 27·3 miles, and the actual length of Narraway River from the Boundary crossing to the forks may be assumed to be about 35 miles, indicating an average fall of twenty-three feet per mile.

In the vicinity of the Boundary, the average depth of the Wapiti valley below the top of the cut-banks which closely confine it on both sides varies from 500 to 800 feet.

Above the forks, Wapiti River has a channel with an average width of 300 feet, and a current which varies from five and a half to seven miles per hour, with many small rapids. On the 13th June, 1922, the rate of discharge was estimated to be 5280 cubic feet per second, while on 5th August, 1922, it was estimated to be 1030 cubic feet per second.



WAPITI RIVER NORTH FROM MONUMENT 66-2

It was noted that along the river narrow flats alternated with steep cut-banks. On the flats there is generally speaking some good spruce and aspen timber running up to twenty inches in diameter, but the flats are only a few chains in width. Excepting this no valuable timber was seen in township 66; nothing but scrub and heavy windfallen brûlé.

From the south boundary of township 66, the survey trail follows the old Calahoo trail from a point about half a mile east of the Boundary. Calahoo trail, however, shortly runs into so much bad muskeg that it was found necessary to cut a new trail, three miles long, to connect with the Calahoo trail where it leaves the high plateau and descends to the river, at a point about ninety chains

east of the Boundary and three and a quarter miles north of the south boundary of township 66. From the above point a spur trail was cut west to what was known as Hill camp. North and west of Hill camp the upper banks of Wapiti valley are bare and grassy, affording the only horse-feed found in township 66, except the marsh feed to the west of line at the extreme south end of the line.

From the point on the top of the hill, Calahoo trail descends 750 feet to the river by a very steep trail; it was found impossible to keep a pack on a horse going up the hill without the use of breast-plates.

From where Calahoo trail comes out on the river bank, it is about a quarter of a mile upstream to the head of the ford, which is just below a curious slide that blocks up half the channel, and crosses the river diagonally downstream, in a northerly direction. The ford is three and a half miles downstream from the Boundary crossing, although only one and a half miles due east from it. During high water, which occurred in the first two weeks of June, 1922, the ford was impassable and, on account of the character of the banks, the horses had to be swum across farther upstream. At ordinary stages of the water the ford is shallow and has a good bottom.

After crossing the ford, Calahoo trail climbs the hill on the north side, which is 495 feet high, and proceeds a little east of north to the settlement at Rio Grande, 37 miles away. From the top of the hill a survey trail was cut west along the high bank, for the transportation of cement, gravel, and camp equipment to the Boundary, but Calahoo trail was used as the main trail. From Wapiti River to Calahoo Lake, which is the only place where there is horse-feed in the intervening distance of nine miles, the trail is very poor and passes through many small muskegs, but is at no time of year impassable.

Six monuments were built in township 66, of which Nos. 66-4, 66-5 and 66-6 are concrete monuments, and the remaining three are of the secondary type.

TOWNSHIP 67

Since the boundary between townships 66 and 67 of the Dominion Lands system of survey is a correction line, township 67 and the three succeeding townships to the north of it occupy a different position in relation to the 120th meridian from the townships lying south of said correction line. From surveyed connection between the Boundary and the north boundary of township 68 (18th Base Line) it is indicated that the 120th meridian lies 56.63 chains west of the east boundary of Range 14 in townships 67, 68, 69 and 70 (measured along the north of township 68).

Through the southerly three and three-quarters miles of township 67 the Boundary traverses the easterly slopes of some low hills, with broken surface and poor soil, reaching its maximum altitude of 3486 feet at Monument 67-2, about one mile north of the township boundary.

At the foot of the above hills, and less than half a mile east of the Boundary, there is a large muskeg area, from one to two miles wide in east-and-west measurement and extending north throughout the entire township. The Boundary

enters the muskeg three and three-quarters miles north of the township boundary, and continues in it for two and a half miles further.

A sluggish creek stream, named Hiding Creek, drains the muskeg north and north-northwesterly, crossing the Boundary half a mile south of the north boundary of the township; it finally enters Redwillow River about five miles upstream from the Boundary crossing.

On the east side of the muskeg, and roughly paralleling the Boundary at a distance of two and a half miles, a low range of hills, similar to those over which the Boundary passes, forms the watershed between Hiding and Calahoo Creeks. It is somewhat curious that all the drainage from about the south boundary of the township should go north through Hiding Creek from a point less than a mile from Wapiti River.

No valuable timber was seen in township 67. All the ridges and hillsides are covered with heavy windfallen brûlé, interwoven with thick second-growth scrub—mostly jackpine.

The big, timbered muskeg, and the impassability of the rough country surrounding it, makes an ideal sanctuary for moose, of which there are many. There are also live beaver dams along Hiding Creek.

An old trail, said to have been cut by a Grand Trunk Pacific Railway exploration party, crosses the line near the south boundary of the township, and runs northeasterly across the muskeg and bordering hills to connect with Calahoo trail about a mile south of Calahoo Lake. It was probably run in early spring, before the frost was out of the muskeg. At the present time it is so badly obstructed by fallen timber on the ridges and passes through so many swampy places, that it is almost impossible to get over it.

In 1920, which was a wet season, great difficulty was experienced in making a horse trail through township 67. The muskegs were belly-deep while, on the other hand, every dry ridge was so encumbered with brûlé that trail-making was a very laborious business. In 1922, which was one of the driest seasons on record, it was found possible to locate a practicable horse trail in the muskeg. Places in the muskeg where there were twelve inches of standing water in 1920 were so dry in 1922 that the party had to dig wells three and a half feet deep in order to obtain water for making concrete. The 1922 survey trail followed the line all the way to Hiding Creek; it then followed the bank of the creek northwesterly for one and a half miles, after which it turned due east to the Boundary again. The only available horse-feed was of the muskeg grass varieties.

Six monuments were built in township 67, all of which are concrete monuments except No. 67-6, of the secondary type, situated on the north bank of Hiding Creek.

TOWNSHIP 68

About half a mile north from the south boundary of township 68 the line emerges from the muskeg and rises 300 feet to the summit of a long fire-devastated ridge which forms a local watershed between Hiding Creek and the east-flowing tributaries of Redwillow River. The highest point of the line occurs

two miles north of the township boundary at Monument 68-2, and has an altitude of 3,426 feet. Here again is another instance of a main ridge which, while lower than the next main ridge to the south, is higher than any point so far discovered to the north. From Monument 68-2, a fine view of the mountains to the south is obtained.

From Monument 68-2, the surface gradually falls 400 feet to a small creek which crosses the Boundary in a northeasterly direction at the extreme north end of the township.

The whole six miles of Boundary in township 68 is one unbroken vista of sparse second-growth jackpine, with bleached skeletons of long-dead trees standing up out of it everywhere—as far as can be seen in all directions. Beneath the sun-scorched scrub, the surface is cumbered with heavy brûlé piled up from four to six feet high. The soil was so badly burned at the time of the big fire (from fifteen to twenty-five years ago) that there is very scanty vegetation of any kind. Even the boulders are riven asunder—probably by rain falling on them when red-hot. Altogether township 68 presents a more complete picture of desolation than any other township along the entire Boundary. And yet—after a lapse of perhaps twenty years—spruce seedlings are beginning to spring up under the partial shade protection of the jackpine second-growth.

It is an extraordinary law of nature, which is familiar to all woodsmen, that whenever spruce woods are burned down, the first trees of the second-growth are almost invariably either jackpine or aspen. Then, when the jackpine or aspen have grown large enough to afford a certain amount of cover, the spruce again begins to assert its supremacy in the forest world.

Before the country described above can be considered to have any value, the brûlé will have to be cleared by another fire—either natural or controlled. It will then slowly become reafforested under reasonably safe conditions.

The survey trail through township 68 follows the line all the way. The brûlé is so universal that it was considered better to do all the heavy work, which the making of a trail through such country entails, right on the line itself. As an instance of the impassable condition of the country, it may be stated that there were five continuous miles of trail in this section that the horses could not possibly get out of on either side. There are no old trails; the Indians will not even hunt moose through such country, because they cannot get the meat out. There is a little horse-feed about twenty chains east of the Boundary along the north boundary of the township, but none at all anywhere else.

Connection was made between the survey of the Boundary and that of the 18th Base Line, along the north boundary of the township.

Five concrete monuments were built in township 68.

TOWNSHIP 69

Township 69 is the most southerly township to exhibit the general characteristics of the great plateau which covers the greater part of the Northwest. Just as Narraway River sharply defines the end of the mountain region,

so does township 68 mark the end of the foot-hill country. South of township 69 all altitudes on the Boundary are above the 3,000-foot contour line, with the single exception of the deep valley of Wapiti River. North of it, for the 173 miles to the end of the work, only Clear Hills rise above 3,000 feet. To the north also there are less sudden variations in altitude; the ridges are lower, and the valleys are less deep, until the ultimate drainage level of the whole enormous territory is reached in Peace River.

In the southerly three and a half miles of township 69 the Boundary crosses a number of wet muskegs, with low jackpine ridges between them.

Four and a half miles north of the township boundary a small stream, named Lattice Creek, crosses the Boundary in a shallow valley, fifty feet below the general surface level, flowing in a northeasterly direction. It is ten feet wide, twelve inches deep and has a sluggish current.

North of Lattice Creek the surface is gently undulating, with an imperceptible general fall from west to east, and is covered with scrub timber and much heavy brûlé. There is no valuable timber in township 69.

Half a mile south of Lattice Creek, an old Indian trail crosses the Boundary in a southwesterly direction from the settlement at Rio Grande; it has been cut out as a rough wagon trail for about a mile beyond the Boundary, where it runs into some extensive hay meadows. Mr. Cautley was told by Indians that the above trail was much used by trappers, and extended "a long way" into the mountains.

Owing to the muskegs in the south half of the township, and the fact that they extend long distances east and west of the line, it was necessary to make wide detours with the survey trail. For the first mile and a half the trail follows the line; it then turns east and north for two miles, round the edge of a long belt of quaking muskeg, to an Indian pack-trail, on which it returns for one and a quarter miles to the line, a little north of Monument 69-3. Crossing the line to the west, it enters the hay meadows at the head of Lattice Creek in about a mile, and connects with the wagon trail, which it follows back to the line at Monument 69-5. From 69-5 north it follows the line. There is excellent feed in the above meadows, but nowhere else in the township.

Seven concrete monuments were built in township 69.

TOWNSHIP 70

South of Redwillow River, which is crossed by the Boundary two miles north of the south boundary of township 70, the surface is nearly level, with many small muskegs and willow marshes alternating with low, aspen-covered ridges.

Redwillow River has been fully described on page 107. It was an important place from the point of view of the survey; first, because it was the only point along the Boundary between Wapiti and Pouce-Coupé Rivers at which first-class gravel could be secured for building monuments, more than forty tons

having been packed from it to monument sites both north and south; secondly, because it was an excellent horse camp, in a country where good horse-feed is scarce.

North of the Redwillow River, the line passes over a low aspen-covered ridge into a wide low-lying valley, which forms the extreme headwaters of Beavertail Creek, draining to the east. The valley contains large areas of grass marshes and tamarack swamps, and extends to within half a mile of the north boundary of the township, which occurs on the south end of higher ground.

Except in the swamps, the surface is very badly burned. In 1920 there was less wind-fall in this township than in any of the others surveyed that year, and in 1922 fires were burning more or less all summer right across the line. Some of the ridges surveyed over in 1922 were burned clean—nothing but blackened earth and white ash left. There is no good timber in township 70, except for a few trees along Redwillow River.

Half a mile north of Redwillow River there is a wagon trail from Rio Grande, which extends to meadows about two miles west of the line, and has been used as a hay trail. It is thirteen miles from the Boundary to Rio Grande. About half way between the two the most amazing difference takes place in the aspect of the country. The barren, burned and marshy country through which the Boundary runs, with its scrub timber, sour soil and scant vegetation, gives place to the fertility of an exceptionally good farming district, with splendid crops and not a muskeg in sight. The survey trail follows the line practically all the way.

Seven concrete monuments were built in township 70.

TOWNSHIP 71

Since the boundary between townships 70 and 71 of the Dominion Lands system of survey is a correction line, township 71 and the three succeeding townships to the north of it occupy a different position in relation to the 120th meridian from the townships lying to the south of said correction line. From surveyed connection between the Boundary and the north boundary of township 72 (19th Base Line) it is indicated that the 120th meridian lies 3.86 chains measured along the base line west of the east boundary of Range 14 in townships 71, 72, 73 and 74.

The surface throughout township 71 is gently undulating, the extreme variation in altitude of points along the Boundary lying between 2835 and 2907 feet above sea-level. It falls, very gradually, from west to east.

In 1920 there was much wind-fallen brûlé all along the line in township 71, but in 1922 a great deal of it had been cleared by successive fires. The soil is badly burned, but the bottom is now so comparatively clear that the risk of future fires is very much minimized, and the next crop of seedlings may survive. When second-growth timber grows high enough to shade the ground, a moist bottom is produced which tends to cause rot of any old brûlé that may still

be present, aids conservation of moisture in the soil, and, while reducing the risk of fire, greatly accelerates the growth of forest trees.

Two and a half miles north of township 70 a very small stream, named Graham Creek, flows northwesterly across the Boundary. About two miles west of the Boundary there is a local watershed, from which drainage flows east and west, so that the line is very nearly on a height of land.

In 1920, while exploring for a trail to Rio Grande, the packers of the party reported a large area of valuable hay land in the east half of township 71, Range 13.

No old trails cross the line in township 71, and the survey trail follows the line all the way. From the worn condition of the trail, in 1922, it is evident that the Indians use it considerably as a hunting trail. There is good horse-feed along Graham Creek, and nowhere else, along the line, in township 71.

Six concrete monuments were built in township 71.

TOWNSHIP 72

The surface in township 72 drains easterly, and is gently undulating, points along the Boundary varying in altitude between 2,800 and 2,900 feet above sea-level.

Three miles north of the south boundary of the township, Steeprock Creek crosses the Boundary in a general easterly direction, although it is flowing southeast at the actual crossing. Steeprock Creek is twenty feet wide, with sluggish current broken by occasional riffles. In the extraordinarily dry autumn of 1922 it had no perceptible flow, the water lying in holes and running subterraneously from hole to hole. It flows through a wide, shallow valley, thirty feet below the general level of the surface to the south of it and ninety feet below a ridge to the north of it. Steeprock Creek flows out of a lake, about 700 acres in extent, named Fritton Lake, which lies nearly a mile to the west of line.

Fritton Lake has the appearance of being deep, and there are fish in it. Its outlet into Steeprock Creek is a mere overflow above a solid bank, so that it probably maintains a constant water level.

One and a quarter miles north of the township boundary, a slough creek, with no apparent flow, crosses the Boundary flowing northeasterly into Steeprock Creek from some hay meadows which are close to the Boundary on its west side. The above hay meadows are about 150 acres in extent, and hay was cut on them in 1922.

There is some fairly good land for a mile north of Steeprock Creek and Fritton Lake, covered with aspen and clump willow, besides the above described hay meadow. Otherwise the soil is badly burned, or marshy.

In this township also, as in township 71, much of the heavy brûlé which was found in 1920 had been cleared by fire in 1922. There is no valuable timber.

A few half breed families have houses on the north shore of Fritton Lake, and regard the location as their headquarters. The men, of whom three were

on the party in 1920, are particularly good trappers and hunters, who work in summer-time on the farms in the settlement, or at whatever other employment they can get, but it is amazing how improvident they are. For instance, there is excellent soil all around their village, where the women and unemployed men loaf away the hot summer, and do not even grow potatoes. They have horses, but put up just enough hay to bring them through a mild winter. Rather than put up a few extra tons—with hay going to waste all around them—they will take chances on losing their horses, which they very much need to provision their trap lines, pack in meat, etc. In the particularly bad winter of 1919-20 the Indians lost fully half of their horses.

There is a rough wagon trail on the north side of Steeprock Creek, from Fritton Lake to the settlement at Hythe. There is also a pack-trail from the village which crosses the Boundary in a north-northeast direction, near the north boundary of the township, and connects with the Beaverlodge trail. The survey trail follows the line all the way. There is good horse-feed at the hay meadow near the south boundary of the township, at Steeprock Creek and at some marshes about two miles north of Steeprock Creek.

Connection was made between the survey of the Boundary and that of the north boundary of township 72 (the 19th Base Line) as well as with all the subdivision monuments established on the Boundary line by the subdividing surveyors.

Six concrete monuments were built in township 72.

TOWNSHIP 73

From the south boundary of township 73 the Boundary passes through two miles in which there are some large areas of tamarack swamp and muskeg, and rises gently to the summit of a high, flat-topped ridge which forms the watershed between Steeprock Creek and Beaverlodge River. From the northerly brow of the above ridge, which has a maximum altitude of 2,950 feet, the surface slopes gently north, northeast and northwest to Beaverlodge River and a small lake, about one and a half miles west of the Boundary, which is also called Beaverlodge.

Beaverlodge River is a sluggish stream, ten feet wide and two feet deep, which crosses the Boundary in a general easterly direction four and a half miles north of township 72. At the end of the dry season of 1922 there was no water in it at the Boundary. It flows through a wide, shallow valley out of Beaverlodge Lake, and is bordered by muskegs and wet hay marshes, alternating with low jackpine ridges.

Beaverlodge Lake is about 315 acres in extent and is shaped like a Wellington boot, with the toe at the southwesterly extremity. It is surrounded by a few chains of hay marsh which the Indians have been in the habit of cutting for hay. It is fed by tiny rivulets, but is practically the head of the Beaverlodge watershed system.

From Beaverlodge River the Boundary gradually rises to the easterly slopes of a long north and south ridge, which extends six miles northerly.

No valuable timber was found along the Boundary. The surface is covered with scrub second-growth timber and a great deal of heavy, wind-fallen brûlé—particularly on the north side of Beaverlodge River. There are a number of small muskegs. The soil varies from fair to poor, and is unfit for agricultural settlement.

There is a rough winter sleigh trail from Beaverlodge Lake, which follows the river east and connects with Fort St. John wagon road at Horse Lakes Indian Reserve. A powerful four-horse team managed to get over the trail with 2000 lbs. of survey supplies, in 1920, but the fact should be regarded as a notable achievement rather than as an indication of the fitness of the trail for wheeled traffic. The survey trail follows the line throughout the township. The only available horse-feed is in hay marshes along Beaverlodge River, and around Beaverlodge Lake.

Six concrete monuments were built in township 73. It should be noted that there is no monument numbered 73-6. Monument 73-7 was built as the most northerly monument in 1919, and was numbered in expectation that it would be necessary to build six more monuments in township 73, but this was not found expedient.

TOWNSHIP 74

The Boundary throughout township 74 traverses the easterly slopes of a long north and south ridge having an altitude of over 3000 feet, although the line reaches a maximum altitude of 2945 feet, and only shows a variation in altitude of 85 feet in the entire six miles.

Monument 74-8 is 7.00 chains south of the north boundary of township 74, and was the most southerly monument built in 1918; it is on the northerly brow of the above ridge, and overlooks to the north Swan Lake and the Pouce-Coupé valley.

Three and a half miles north of township 73 the Boundary crosses an obscure watershed between Smoky and Pouce-Coupé River basins; south of the watershed the surface falls gently in a southeasterly direction and is drained by Beaverlodge River; north of it, a number of small ravines cross the line in an easterly direction to a small stream flowing northeasterly, which eventually flows into Swan Lake.

The whole of township 74 has been burned over, and is covered with second-growth scrub and brûlé; the southerly half is badly encumbered with wind-fallen brûlé, but successive fires have cleared most of the wind-fallen timber in the northerly half.

The soil has been badly burned as a rule, and is unfit for settlement, but the high ridge passed over in this township would make a good timber reserve, and the timber would be valuable owing to its nearness to settlement.

The northwest quarter of township 74, Ranges 13 and 14, had been subdivided between 1920 and 1922, and connection was made between the survey of the Boundary and all subdivision monuments established on the line.

Eight concrete monuments were built in township 74.

TOWNSHIP 75

Since the boundary between townships 74 and 75 of the Dominion Lands system of survey is a correction line, township 75 and the three succeeding townships to the north of it occupy a different position in relation to the 120th meridian from the townships lying to the south of said correction line. From connection made between the survey of the Boundary and that of the north boundary of township 76 (20th Base Line) it is indicated that the 120th meridian lies 435.61 chains west of the east boundary of Range 13, in townships 75, 76, 77 and 78, measured along the base line.

Monument 74-8, which is 7.00 chains south of township 75, is on the crest of a long descent to the north, overlooking Swan Lake (500 feet below) and the Pouce-Coupé valley. Looking north the whole aspect of the country is different from that so far encountered; first, the general plateau level to the north is materially lower, and does not regain the altitude of Monument 74-8 for 73 miles, or 26 miles north of Peace River; secondly, the soil has not been damaged by fire to anything like the same extent, and is fertile.

In the first one and a quarter miles the line descends 400 feet to Monument 75-1, over a long hill with due north exposure which has been so badly burned that there is nothing left except fire-split boulders, and a little scanty scrub. From 75-1 the line passes over a level and badly burned flat for 50.00 chains, and crosses a creek flowing west, which enters the most southerly arm of Swan Lake. North of the creek the soil does not appear to have been damaged by fire.

Two and a half miles north of township 74 the Boundary passes the southerly end of Swan Lake and, for the next three miles, it closely follows the east shore of the lake, cutting off a few chains of a bay at its extreme north-easterly corner, whence it passes through a tamarack swamp to the north boundary of the township.

Swan Lake is a pretty lake about three miles long in a north and south direction and three-quarters of a mile wide, and covers about 1287 acres. The lake is shallow and weedy around shore and affords a breeding place for thousands of waterfowl; at the same time there must be deep water somewhere in the lake, because there are whitefish in it. Four permanent creeks empty into the lake—three small ones from the east, and a larger one, named Tupper River, at the southwest angle. The continuation of Tupper River flows out from the west side of the lake and, turning northerly, joins Pouce-Coupé River ten miles further north. Above the forks Pouce-Coupé and Tupper Rivers carry about an equal volume of water, and are the main branches of Pouce-Coupé River. The altitude of Swan Lake is 2374 feet.

East and north of the lake, the surface is broken by ridges which abut on it, and rise from 200 to 350 feet above it. At the south end of the lake there are some beautiful meadows owned by a rancher, Ellis Borden by name (this is the first occupied land to be crossed by the Boundary).

West and north-northwesterly—along Tupper River—there is good land, and there are a few settlers in this direction.

Practically all the country has been burned over, and it is covered with aspen second-growth, but the soil does not seem to have been damaged and there is very little brûlé left cumbering the surface.

The Fort St. John wagon road and Government Telegraph line cross the Boundary in a west-northwesterly direction twelve chains north of Monument 75-1; after passing around the south end of Swan Lake, they turn northerly. The main survey trail follows the line as far as Fort St. John road; then turns west along the road to the north side of the bridge across Tupper River; then follows a lake-shore wagon trail right around the west and north sides of the lake, and reaches the line again about half a mile south of township 76. There is abundant horse-feed at many places around the lake.

Surveyed connection was made between the Boundary and the N. E. corner of Section 36, Township 26 of the British Columbia system of survey.

A line of precise levels has been established along the Fort St. John wagon road, and it is to the datum of bench marks on this line that all levels taken along the Boundary have been reduced, and to which the altitudes adopted are referred.

Five concrete monuments were built in township 75.

TOWNSHIP 76

In township 76 the Boundary passes over a rolling surface, partly open and partly covered with small aspen, with occasional small muskegs in the hollows. It is a good grazing country, although the surface is generally too uneven to make it suitable for agriculture.

On the west, Tupper River roughly parallels the Boundary at a distance which varies from one and a half to two and a half miles; the valley is from 150 to 300 feet deep and has rather steep sides. Immediately adjoining the river, on both sides, there is good land.

Towards the northern limit of the township the Boundary rises to the summit of a ridge with a maximum altitude of 2692 feet, on which it intersects the north boundary of the township (being the 20th Base Line). The above intersection is the southeast corner of the Peace River Block.

Connection was made between the survey of the Boundary and that of the 20th Base Line, and level ties were also made to bench marks established on it.

In 1918 there were no trails near the Boundary other than the survey trail, which follows the line closely all the way.

Seven concrete monuments were built in township 76.

TOWNSHIP 77

From the south Boundary of township 77 the surface falls steadily to Pouce-Coupé River, which is nearly 600 feet lower than Monument 77-1. The river crosses the Boundary, in a general westerly direction, two miles north of township 76, and joins Tupper River one and a quarter miles west of line. From



POUCE COUPÉ RIVER UPSTREAM FROM BOUNDARY

the junction Pouce-Coupé River runs northwesterly to the town of Pouce-Coupé, which is five miles west of the Boundary and half a mile south of the north boundary of township 77. It is a pretty stream, about fifty feet wide, flowing in a gravelly bed through a winding valley with irregular, aspen-covered banks about 400 feet high.

North of the river, the Boundary follows a wide valley, which becomes gradually narrower until, at the north boundary of the township, it is confined between hills about 250 feet high. The small creek which runs south through the above valley crosses the Boundary many times.

Throughout township 77 the surface is mostly covered with thick small aspen, alternating with open grassy glades and occasional swamps. It is so broken up as to be unfit for agriculture, but affords splendid summer pasture. Even in the aspen groves, peavine and vetch grow three and four feet high, and the survey horses got so fat that all their cinches had to be let out. There is very little brûlé on the ground.

About a mile north of Pouce-Coupé River a good pack-trail crosses the line in an east-southeast direction from Pouce-Coupé settlement, crossing to the south side of the river about two and a half miles east of line. The survey trail follows the line closely.

It was along the north boundary of township 77 that the survey was made from the concrete longitude pier established by Mr. McDiarmid at Pouce-Coupé in order to determine an initial point on the 120th meridian. Monument 78-1 was established as the initial point of the 120th meridian survey, at a point 3·079 chains north of the north boundary of township 77. It is 415·518 chains east and 31·868 chains north of the longitude pier.

The north boundary of township 77 passes over two distinct north and south ridges between the river and the boundary, of which the more westerly is 2700 feet high and the other is over 2600 feet. This is mentioned to illustrate the difference in the character of the country lying to east and west of Pouce-Coupé River. West and north of Pouce-Coupé settlement the general surface is that of a gently undulating plateau with an altitude which varies between 2050 and 2150 feet above sea-level; while, east of the river, until the middle of township 78 is reached, there are numerous ridges up to 2700 feet, and even the valleys are considerably higher than the Pouce-Coupé plateau.

Seven concrete monuments were built in township 77.

TOWNSHIP 78

Proceeding north from Monument 78-1, the surface rises 240 feet in a distance of 95·00 chains to the summit of an east and west ridge which forms a local watershed between tributaries of Pouce-Coupé River. Monument 78-2 was built on the above ridge and was found to have an altitude of 2585·10 feet. From Monument 78-2 the whole country to the north lies open; it is the highest point for fifty miles, and the gap through the timber made by the line is visible from almost all points of the survey for more than forty miles. The ridge falls away to the north in a long, even slope for two and a half miles to a small tributary of Pouce-Coupé River, named Sergeant Creek, which crosses the line in a westerly direction and then, turning northeast, again crosses it, to the east, five and a quarter miles north of township 77.

After crossing Sargeant Creek the country stretches out into a wide plateau with a gently undulating surface having an altitude which does not vary more than fifty feet from 2100, except when broken by the valleys of Pouce-Coupé River or its tributaries, for a distance of eighteen miles. The above plateau is an easterly extension of the Pouce-Coupé settlement area, and forms part of it. The level of the plateau at the north boundary of the township is 450 feet below the ridge on which Monument 78-2 is situated.

The southerly two and a half miles of township 78 is covered with thick green aspen and willow; the soil is good and the slopes are so gradual that it will doubtless be taken up as farm land. The next half mile is covered with heavy, standing brûlé, and the remaining three miles are on the eastern edge of Pouce-Coupé settlement, and are fenced and occupied.

Township 78 has been subdivided and, being within the Peace River Block, which is surveyed right across the Boundary as a normal extension of the Dominion Lands system, it follows that the Boundary cuts across the various farms in its path, so that these farmers find parts of their farms in the territorial administration of Alberta and parts in that of British Columbia.

Connection was made between the survey of the Boundary and several of the east and west subdivision lines, as well as with the north boundary of the township.

The end of the railway grade from Spirit River towards Pouce-Coupé approaches the Boundary, on its easterly side, within half a mile at a point four and a half miles north of township 77. The grade was built in 1916 under the charter of the Edmonton, Dunvegan and British Columbia Railway, and it was confidently expected by Pouce-Coupé settlers that the line would be completed at an early date. These hopes have never been realized, and its non-fulfilment has been the cause of a serious setback to the prosperity of the settlement.

There are numerous roads and trails across the line in township 78. The survey trail follows the line for two and a half miles, and then swings easterly round some heavy brûlé into the settled part of the township.

Five concrete monuments were built in township 78.

TOWNSHIP 79

Since the boundary between townships 78 and 79 of the Dominion Lands system of survey is a correction line, township 79 and the three succeeding townships to the north of it occupy a different position in relation to the 120th meridian from the townships lying to the south of said correction line. From connection made between the survey of the Boundary and that of the north boundary of township 80 (21st Base Line) it is indicated that the 120th meridian lies 377.48 chains west of the east boundary of Range 13 in townships 79, 80, 81 and 82, measured along the base line.

Township 79 exhibits the same general characteristics as township 78; that is to say, the surface is an undulating plateau varying in altitude from

2050 to 2150 feet; it is more or less covered with scrub second-growth timber and old brûlé, and the soil is a blackish clay loam with stiff clay subsoil.

Most of the township through which the line passes is already taken up by settlers.

About a mile north of township 78, Sergeant Creek¹ again crosses the Boundary from east to west, and, for the next mile and a quarter, the Boundary for the most part follows the rough and deep valley of this tiny stream to its junction with a larger one, named Henderson Creek,¹ Henderson Creek is ten feet wide and six inches deep; it crosses the Boundary in a general westerly direction and enters Pouce-Coupé River half a mile west of the Boundary.

Four and three-quarters miles north of township 78, Pouce-Coupé River just crosses the line, and then swings back over it and makes a final crossing to the east 28·00 chains further on. The general direction of the river for some distance on either side of the line is northeasterly, but it flows through a box-canyon, 350 feet deep, which turns and twists in very abrupt loops. The bed of the river is about seventy feet wide.

The rate of discharge varies tremendously in Pouce-Coupé River, and, at low water stages, is so small in proportion to the watershed area which it drains as to suggest subterranean drainage. Apart from the otherwise inexplicable shrinkage of flow in such rivers as Pouce-Coupé, there are two other circumstances which lend colour to the idea of subterranean drainage on a large scale throughout the country; first, the great depth of the ultimate drainage level of the whole territory (Peace River) below the general plateau level; for instance, the above crossing of Pouce-Coupé River is only seventeen miles from Peace River, and yet the general plateau level, to within a few miles of the river, is 800 feet above the bed of Peace River, and the bed of Pouce-Coupé River is 444 feet above it. In the second place there is abundant evidence of seepage along the banks of Peace River itself.

While the soil appears to be excellent, and the general surface to be so gently undulating as to be almost ideal for farming operations, township 79 presents one great disadvantage from a prospective settler's point of view which is common to all land on both sides of Peace River valley, and which becomes more acute as one nears the valley itself, namely the great depth and steep slide-bank character of all tributary valleys, however small the amount of water they may carry. For instance, Sergeant Creek is practically a surface creek in township 78, but in township 79 it has a valley which, at its mouth, is 300 feet deep and half a mile wide, although the amount of water carried in the creek itself is a mere dribble at normal stages of flow. Henderson Creek valley is also 300 feet deep and about half a mile wide, but it carries a considerable stream, while Pouce-Coupé River valley is 350 feet deep and so steep-sided that it may properly be described as a canyon. The disadvantage of the above described formation is two-fold: first, it makes all practicable routes of travel

¹ Both Sergeant and Henderson Creeks are named after the picketman of the party in 1919. Robert Henderson, who, as an officer of the 49th Battalion C.E.F., won both the Military Cross and the Distinguished Conduct Medal for conspicuous bravery in the war of 1914-18.

devious and therefore expensive to haul loads over or to construct roads along; secondly, it means that the only permanent water supply is so deep down below the surface of the agricultural land that the settler will have to depend on deep wells, which are costly both to construct and to operate. From conversation with farmers of the district it would appear that it is generally possible to get water for summer use from shallow wells, but that the water thus obtained is really surface seepage, rather than a true underground flow, and that all such wells freeze up in winter.

There is a good pack-trail along the north bank of Henderson Creek which leads from Pouce-Coupé settlement to Spirit River. The survey trail follows the line as far as the edge of Sergeant Creek valley, along which it follows the westerly edge and descends into the bottom of Henderson Creek; following down Henderson Creek to Pouce-Coupé River, it ascends the westerly bank of the latter, which it follows back to the line, about half a mile south of township 80. There is good pasture almost everywhere in the township.

Township 79 has been subdivided and several connections were made between the survey of the Boundary and the subdivision lines, including the north boundary of the township.

Seven concrete monuments were built in township 79.

TOWNSHIP 80

The southerly three miles of township 80 are a continuation of the gently undulating plateau previously described, varying in elevation from 2070 to 2100 feet. The surface is largely cleared by fire and there are many areas of almost open prairie, alternating with bluffs of scrub aspen, or standing brûlé. The soil is a blackish clay-loam with a stiff clay subsoil.

There are well developed farms close to the line on the British Columbia side which showed very heavy stands of wheat and oats in the season of 1919.

The northerly three miles of township 80 is a continuation of the same plateau, but is covered with thick, tangled brûlé and second-growth scrub aspen, and is much cut up by numerous small grass marshes and hummocky knolls.

Doe Creek crosses the line from west to east in section 29, having a valley about 250 feet deep and 24.00 chains wide; it is eight feet wide and six inches deep with very little current. The valley of Doe Creek is only 50 feet deep one mile west of the Boundary, whereas it both widens and deepens very quickly as it approaches the valley of Pouce-Coupé River, which was estimated to be 350 feet deep near its intersection with the north boundary of the township.

As all the land in this township, to the west of Pouce-Coupé River, is an unbroken continuation of the same plateau on which the present farming settlements of Pouce-Coupé and Rolla are situated, it is not subject to the disadvantages of inaccessibility described as applying to township 79.

Numerous wagon trails cross the lower half of township 80. The survey trail follows the line all the way. There is abundant pasture almost anywhere, but not much water.

Township 80 has been subdivided, and several connections were made between the survey of the Boundary and the subdivision lines.

Seven concrete monuments were built in township 80.

TOWNSHIP 81

In township 81, sections 1 to 4, 9 to 12 and the south halves of 13 to 16 are much cut up by the valley of Doe Creek, and sections 25, 35 and 36 by the valley of Pouce-Coupé River, but, apart from the above mentioned sections, the whole township is a continuation of the main plateau, the altitude of points along the Boundary ranging from 2070 to 2120 feet.

The south half of section 29 consists of a wet grass marsh of considerable extent, which drains into a small tributary of Peace River, named Merlin Creek.

It was found necessary to cut a gravel trail, six miles long, from the north-east corner of section 8 to Pouce-Coupé River, around the bend of Doe Creek, and the character of the surface was found to be very similar throughout. Fire has run through almost all of the township, and the surface is covered with brûlé, alternating with thick aspen groves and standing brûlé, except for a few sections in the southwest corner of the township which have been cleared by successive fires. The fires seem to have occurred at seasons of the year when the soil is not materially damaged by fire. No valuable timber was seen in the township. There are a great number of small grass marshes, separated by low knolls, but muskeg areas are few and unimportant.

Ultimately township 81 will naturally become an extension of the Pouce-Coupé and Rolla farming district, but, having regard to the present cumbered state of its surface and the rather large proportion of marshy land met with, it should be described as second-class land.

Township 81 has been subdivided and several connections were made between the survey of the Boundary and the subdivision lines.

No old trails cross the Boundary in this township, and the survey trail follows the line all the way. There is abundant pasture.

Six concrete monuments were built in township 81.

TOWNSHIP 82

Township 82 is so much cut up by the valley of Pouce-Coupé River, by Merlin Creek, which enters Peace River about a mile east of the Boundary, and by the valley of Peace River itself that only a small and irregular part along the south boundary of the township is on the general plateau level. The surface is covered with brûlé and second-growth aspen until the banks of Peace River are nearly reached, where there is a belt of spruce up to eighteen inches in diameter for a distance of about one mile back from the river.

The Boundary crosses Peace River just west of the northerly apex of a wide curve to the north. At the actual crossing the river is running due north-east, but, within a quarter of a mile downstream, it turns southerly. The immediate banks are higher and steeper than at any other point noticed in the 150 miles between the Boundary and town of Peace River.

The last monument built on the south side is No. 82-5, at an altitude of 1,758·14 feet. Half a mile east of Monument 82-5 the river bank rises about 200 feet higher and makes a bold approach to the very edge of the valley, constituting a notable headland which river men call Black Point.

From 82-5 the surface falls away in a broken mud slide for 7·00 chains and then breaks over a very steep 300-foot cut bank, at the foot of which another mud slide continues to the very edge of the water, so that it was impracticable to build a monument on the south bank of the river, although it would have been desirable to do so, if possible. From Monument 82-5 to the water's edge is a distance of 17·00 chains, in which there is a drop of 503 feet, the altitude of water level having been found to be 1255 feet at an ordinary summer stage of water. The bed of the river itself is 23·50 chains, measured along the Boundary, but is only 13·00 chains wide measured at right angles to its course. On the north side there are 12·00 chains of an old slide leading up from the water's edge to the foot of a very steep, grassy side-hill, which extends without a break to the general level of the plateau above, so that Monument 82-7, which is built only 0·45 chains from the sharply defined edge of the side-hill, has an altitude of 2012·75 feet and is fairly on the plateau itself. From Monument 82-5 to Monument 82-7 the total distance is only 68·396 chains.

Monument 82-6 was built on a slight ridge of the old slide formation leading up from the water's edge; it is 5·00 chains from the river bank, and 22·605 from Monument 82-7. It has an altitude of 1345·02 feet, and is therefore about ninety feet above ordinary water level. Monument 82-6 is plainly visible from the river for some distance in either direction.

From Monument 82-7 to the north boundary of the township is half a mile, and the surface is nearly level, with light aspen scrub and a little half-burnt brûlé.

The timber along the south shore of the river, west of line, while small in area, is of fair quality and could be got to market so cheaply that it is valuable.

South of Peace River, township 82 has been subdivided, and connection was made to two of the subdivision lines. North of the river the only lines of the Dominion Lands system which cross the Boundary are the 22nd and 23rd Base Lines—along the north boundaries of townships 84 and 88 respectively.

No old trails were found in township 82. The survey trail follows the line as far as Monument 82-4; it then turns easterly to the west bank of Merlin Creek, which it follows down to the river, coming out on the downstream end of a mile-long gravel bar; following the bar upstream as far as the stage of water permitted, the horses were swum across the river to a gravel bar just above

the boundary. Coming south, horses were swum from about a quarter of a mile above the Boundary, landing on the long gravel bar on the south side. Altogether seven crossings were made with from five to thirty-two horses, and no difficulty was experienced. On the north side the trail followed up a steep gulch, which comes down a quarter of a mile west of the Boundary, and reaches the line ten chains north of Monument 82-7. It makes a hard climb, but up this trail sixteen tons of gravel, etc., were packed. The only good pasture found along the trail was at the mouth of the above gulch and on the surrounding hillsides.

Seven concrete monuments were built in township 82.

TOWNSHIP 83

Since the boundary between townships 82 and 83 of the Dominion Lands system of survey is a correction line, township 83 and the three succeeding townships to the north of it occupy a different position in relation to the 120th meridian from the townships lying to the south of said correction line: From connection made between the survey of the Boundary and that of the north boundary of township 84 (22nd Base Line) it is indicated that the 120th meridian lies 314.25 chains west of the east boundary of Range 13 in townships 83, 84, 85 and 86, measured along the Base Line.

The southerly two miles of township 83 is good land; the surface is gently undulating and pretty well cleared up by fire, the soil is good and a little stream, named Moonlight Creek, comes within a few chains of the line, on the east side, one and a half miles north of township 82.

Moonlight Creek drains a number of large marshes to the north; it is six feet wide, six inches deep, with a fair current and the flow of water is well maintained, even in October, owing to the nature of its source. Where it approaches the line it is in a shallow valley thirty feet deep, but falls very rapidly and flows into Peace River through a picturesque box canyon rather more than one and a half miles east of the Boundary.

Three miles north of township 82 the line passes through a beaver meadow and willow marsh; in 1919 the marsh was from eighteen to twenty-four inches deep in water, while in 1923 it was practically dry.

For one and a quarter miles north of the marsh, the Boundary crosses a burned area, with gumbo soil and scanty willow scrub.

Five miles north of township 82, the line enters a belt of green timber which extends for two and a half miles north, and beyond the limits of exploration on either side of the Boundary. It is estimated that the above belt contained seven white spruce trees, averaging eighteen inches diameter, to the acre, besides smaller spruce, large aspen and some jackpine. The timber could easily be got out to Peace River.

At the present time what limited market exists for timber along Peace River can be easily supplied from small timbered flats along the river itself, but nothing seems more certain than that the reserves of timber lying between

the mountains and the prairies will be found inadequate to meet the demands of growing development in the next generation.

Nearly four miles north of township 82 an old Indian pack-trail crosses the Boundary in an easterly direction from Fort St. John. The survey trail follows the line all the way. There is good horse-feed around the head of Moonlight Creek and in the beaver meadow.

Six concrete monuments were built in township 83.

TOWNSHIP 84

The southerly one and a half miles of township 84 are covered by the timber belt described as commencing in township 83. There is a lake, about 70 acres in extent and surrounded by a narrow belt of hay slough, a quarter of a mile north of township 83 and three-quarters of a mile west of the Boundary.

For two and a quarter miles north of the timber there is an unbroken stretch of wet muskeg covered with small green spruce, which extends three miles east of the Boundary and as far west as the banks of Moose River (about three and a half miles). This is the first big muskeg area so far encountered, although, as will be seen, it was only the southerly edge of a stretch of country in which there is more muskeg than solid ground. As one travels mile after mile through these big muskegs, the visible horizon is always the same. In every direction may be seen small spruce from ten to thirty feet high with thin, spire-like tops from which the clustered evergreen only extends a few inches and a carpet of green, yellow or white moss with Indian Tea growing through it and shallow pools of stagnant water. On a cloudy day, without a compass, the everlasting sameness of a muskeg makes it very easy to get lost in them.

One surprising fact about these big northern muskegs is that, although they are flat and water-logged, with no apparent drainage, they are by no means level. For instance, the levels taken along the Boundary in the above muskeg show a very gradual, but uniform, rise for the first one and a quarter miles, amounting to six feet, while there is a fall of twenty-one feet in the remaining mile. As a matter of fact the highest altitude reached on line between Peace River and Boundary Lake occurs right in the middle of the muskeg, and constitutes a height of land from which imperceptible drainage flows in many directions.

Curiously enough, one lone jackpine—the only one seen in the entire muskeg—was noticed on line right in the middle of the muskeg. On investigation it was found that the ground was sound for a few feet around it and Monument 84-3 was built there. Of all the hundreds of concrete monuments built, perhaps none occupies so strange a position as No. 84-3.

Beyond the muskeg there is a narrow belt of good spruce timber, and a willow marsh that extends up to the southerly shore of Boundary Lake, where the last concrete monument was built—No. 84-5.

Monument 84-5 is 68.192 chains south from the north boundary of township 84—22nd Base Line—with which surveyed connection was made. Ties were

also made to bench marks on the 22nd Base Line from the Boundary line of levels.

Boundary Lake is a shallow body of water, about two miles long in a north-northwest and south-southeast direction and half a mile wide, and is nowhere more than five feet deep. It is bordered on the west and south by grass marshes from 15·00 to 40·00 chains wide. North from Monument 84-5 the Boundary crosses grass marsh and lake more or less diagonally.

No old trails were found in township 84, and the survey trail closely follows the line all the way. Great difficulty was experienced in making a horse trail across the muskeg. In 1919, after much exploration had proved that it was not practicable to locate a trail around it, and in view of the necessity to deliver monument material to the line, a trail was finally located right through the muskeg a little east of line, and matted with small spruce for a great part of the way. Even with all the work that was done to make it passable, getting the gravel-laden horses across that muskeg was a difficult piece of work. In 1923, after several dry seasons, it was found possible to get the horses over by having them led so that only two or three would follow the same trail. In an ordinarily wet season it would be better to make a wide loop round the west end of the muskeg to Moose River, by way of the Indian trail which crosses the Boundary in township 83 and the Fort St. John wagon road, although doing so would mean the loss of a day. The only good feed in township 84 is at the lake near the south boundary of the township, to which a trail runs from Monument 84-1, and at Boundary Lake.

Five concrete monuments were built in township 84.

TOWNSHIP 85

From the south boundary of township 85 the Boundary crosses the main body of Boundary Lake for a mile and a quarter, after which it enters a thickly wooded marshy bottom, and continues to the north boundary of the township through a nearly level country with a general rise to the north. The surface is marsh or muskeg, alternating with low ridges covered with mixed woods of small growth. No valuable timber was noted near the line.

The altitude of water level in Boundary Lake is 2400·5 feet, while the altitude of Monument 85-4, which is the highest point on the line, is 2479 feet.

South of Monument 85-4, which is four and a half miles north of township 84, the country drains sluggishly into Boundary Lake, and from thence to the west through a small tributary of Moose River which forms the outlet of the lake. The above outlet flows in a west-southwest direction from a point on the west shore of the lake 50·00 chains north of township 84. It is very small, even in June, 1923, it was scarcely running, while in August it was perfectly dry.

Monument 85-4 is itself in a muskeg, but nevertheless appears to be on the watershed between Moose River and a tiny tributary of Clear River which runs southeast from a point on the north boundary of the township 15·00 chains east of the Boundary.

The Fort St. John trail from Dunvegan traverses the township in a south-southwest direction towards Fort St. John. Crossing the Boundary two and a half miles north of township 84, it skirts the northwesterly edge of the grass marsh round Boundary Lake, and follows the outlet of the lake to Moose River. Near the Boundary the trail is located through a long stretch of muskeg and it should be noted that it is a good winter sleigh trail, or summer pack trail, but that it is not fit for wheeled traffic. The survey trail follows the westerly shore of the lake until it cuts the Fort St. John trail; it then follows the latter for three miles beyond where it crosses the Boundary to the north edge of a small muskeg, from which point it is cut as a new trail running northwesterly to the Boundary. There is good feed at Boundary Lake, at a pond on line about a mile to the north of it, and in a beaver meadow near the line at the north end of the township.

Five monuments of the secondary type were established in township 85.

TOWNSHIP 86

In township 86 the surface rises gradually towards the north, from an altitude of 2476 feet on the south boundary to one of 2830 on the north boundary of the township, and drains in a southeasterly direction into Clear River.

After passing through 26.00 chains of muskeg from the south boundary of the township, the Boundary comes to a shallow lake full of reed beds, about 260 acres in extent, and crosses the middle of it. The greatest dimension of the lake is along the line itself and is nearly 70.00 chains, while the width is about 50.00 chains. The outlet is just where the Boundary intersects the southerly lake-shore, and is a small, sluggish creek dammed by beaver in various places. The lake is surrounded on the west, south and southeast sides by muskeg—only about three feet above its water level. To the north and east are ridges covered with aspen, spruce and jackpine up to six inches in diameter.

Two and a quarter miles north of township 85 the line enters a narrow belt of heavy spruce and aspen timber, which extends a mile and a half along the line and is about half a mile wide; the timber runs six to twenty-two inches in diameter, with occasional spruce up to thirty-two inches.

Three and three-quarters miles north of township 85 a small creek, three feet wide with good water, crosses the line in a southeasterly direction.

West of the Boundary, and sometimes extending a few chains across it, the belt of heavy timber continues on both sides of the above creek to the north outline of the township.

In the most northerly half mile of township 86 the Boundary enters a partly open country, with rich soil and many grassy glades alternating with alder and willow.

The survey trail follows the easterly shore of the lake near the south boundary of the township and, thereafter, is within a quarter of a mile of the line throughout. There is good horse feed on the east shore of the lake, and in the open country along the north boundary.

Five monuments of the secondary type were established in township 86.

TOWNSHIP 87

Since the boundary between townships 86 and 87 of the Dominion Lands system of survey is a correction line, township 87 and the three succeeding townships to the north of it occupy a different position in relation to the 120th meridian from the townships lying to the south of said correction line. From connection made between the survey of the Boundary and that of the north boundary of township 88 (23rd Base Line) it is indicated that the 120th meridian lies 258.00 chains west of the east boundary of Range 13, in townships 87, 88, 89 and 90, measured along the Base Line.

The surface in township 87 continues to rise gently from south to north, the altitude on the south boundary being 2830 feet, while that on the north is 3018 feet, and the whole country drains southeasterly to Clear River.

For the southerly three miles of the township the Boundary forms an approximate line of division between partly open country, with grassy glades alternating with belts of alder and willow, to the east of it, and thickly wooded country to the west of it. The open country referred to has rich soil and supports rank vegetation; it is the only first-class land passed over during the 1923 season. Unfortunately there does not seem to be very much of it, although it extends in an easterly direction for some miles. The wooded country to the west contains a little heavy timber, but is mostly mixed woods up to seven inches in diameter.

Three miles north of township 86 the line enters upon low, sandy ridges, covered with light aspen scrub and cut by numerous small coulees leading easterly, of which the largest crosses the Boundary in a southeasterly direction, nearly four miles north of township 86, and forms a main outlet from the big muskeg area to the northwest.

The northerly two miles of the township are covered by a large muskeg area which extends north as far as the foot of Clear Hills in township 88. The muskeg alternates with low ridges covered by four-inch jackpine and it extends as far west of the Boundary as can be seen from the one and a half mile limit of exploration. About two miles to the east of the Boundary, it breaks off into lower country, broken by creek valleys from 150 to 250 feet deep.

Half a mile north of township 86 the Boundary crosses an old pack-trail which runs in a north-northeast direction and leaves the township very close to its northeast corner. From the St. John sheet sectional map issued by the Department of the Interior, Ottawa, it is evident that the above trail is a continuation of the Fort St. John trail which passes around the north side of Cecil Lake.

The survey trail through township 87 is located in close proximity to the line until the muskeg area which occupies the northerly part of the township is reached, but it was found impossible to locate a horse trail through the muskeg. There are many low jackpine ridges throughout the muskeg that seem to lead in the desired direction for a mile or so, but, sooner or later, they run out to a point and submerge in the muskeg. Finally it was found necessary to make a

wide detour to the east from a camp twelve chains east of Monument 87-4. As it is a difficult country to get horses through, a detailed description of the trail is given as follows:

From the camp near Monument 87-4 the trail follows the left bank of the creek south and southeast for a mile; thence it turns north for two miles, along a narrow ridge in the muskeg; thence nearly due east for two and a half miles to where it joins the old Cecil Lake trail described above; thence it follows the Cecil Lake trail northeasterly for about three-quarters of a mile to where the survey trail of the meridian line along the east boundary of Range 13 leaves it, the latter turning sharply to the northwest; thence it follows the meridian survey trail north-northwest for about three miles to a creek in a valley 100 feet deep, where there is good horse-feed; a few chains north of the above creek it turns due west along an old Indian trail to a hunting camp; thence a new trail was cut for a mile westerly, which crosses over the summit of Clear Hills to a camp about 7.00 chains west of the Boundary. The above camp was known as Clear Hills camp and was an important point of the survey because there is good feed there, whereas the next nearest horse camp to the south is thirteen miles distant by trail, and there is no more feed to the north until the third camp from Clear Hills, thirteen and a half miles distant by trail, is reached.

Six monuments of the secondary type were established in township 87.

TOWNSHIP 88

The surface along the Boundary through township 88 rises from an altitude of 3018 feet at the south boundary to 3305 at the summit of Clear Hills, three miles north, and then falls to 2980 feet at the north boundary.

Clear Hills are an irregular system of low hills roughly paralleling the valley of Peace River, and forming the northerly watershed of the Clear River system. While they only have a maximum altitude of about 3600 feet, which is only about 1000 feet above the general level of the surrounding country, they are nevertheless the highest land for perhaps a hundred miles in all directions.

The Boundary crosses the extreme westerly end of Clear Hills; west of line the high land breaks rapidly away into the general valley level.

The general drainage of the country to the south of Clear Hills is southeasterly to Clear River. North of Clear Hills the general drainage is northwesterly to a tributary of Beatton River known as Osborn River.

The most southerly two miles of township 88 are covered by a continuation of the large muskeg area noted in township 87. The muskeg extends at least two miles—and probably much more—to the west; to the east the muskeg extends about two miles and then breaks off into lower country broken by several creeks in valleys over 100 feet deep.

From the northerly edge of muskeg the surface rises 300 feet to the summit of Clear Hills, which occurs nearly three miles north of township 87; the southerly slopes are fire-cleared and grassy in some places, while in others they are covered with thick, second-growth mixed woods. The northerly slopes descend 320

feet in a mile of distance, and the remaining two miles of the township are almost level, with thick mixed woods up to six inches diameter varied by a few small muskegs here and there.

A creek six feet wide crosses the Boundary in a northwesterly direction four miles north of township 87, and is one of the head-water sources of Osborn River.

The survey trail to Clear Hills camp has already been described under heading of Township 87. North of Clear Hills camp it follows the line within a quarter of a mile. There is no horse-feed along the Boundary in township 88 north of Clear Hills camp.

The north boundary of township 88 (23rd Base Line) is the most northerly line of the Dominion Lands system of survey that has been surveyed across the Boundary. Connection was made between the survey of the Boundary and that of the 23rd Base Line, and level ties to bench marks on the Base Line were made from the Boundary line of levels.

Six monuments of the secondary type were established in township 88, of which No. 88-6 was placed at the exact intersection of the Boundary with the Base Line, and is therefore at the northeast corner of the Peace River Block.

TOWNSHIP 89

In township 89 the surface falls continuously to the northwest from its extreme southeast corner, which occurs on the summit of Clear Hills and has an altitude of 3600 feet, to an altitude of 2500 feet at the northwest corner of the township. Of the above 1100 feet of difference, however, only 430 appear along the Boundary, which has an altitude of 2980 feet at the south boundary of the township, and 2560 at the north boundary.

The most southerly four miles are slightly rolling in character and covered with mixed woods up to six inches in diameter, with a great deal of underbrush in places and many small muskegs.

The northerly two miles are nearly level and covered by large muskeg areas alternating with low jackpine ridges.

Numerous small creeks cross the Boundary in a northwesterly direction and form the headwaters of Osborn River, of which the two largest are a six-foot stream at two miles, and a ten-foot stream at five and a quarter miles, north of township 88.

An old Indian trail crosses the Boundary in a north-northeasterly direction a quarter of a mile north of township 88. The survey trail follows the line closely in the southerly four miles, and then makes a detour to the east to avoid muskeg, coming back to the line at the north boundary of the township. There is no horse-feed in this township.

Five monuments of the secondary type were established in township 89.

TOWNSHIP 90

For the most southerly two miles of township 90 the Boundary closely follows the dividing line between a muskeg on the west and a timbered ridge on the east which rises to a height of 400 feet above the line at a distance of one and a half miles from it. There is some good spruce timber on the above ridge and its continuations to the north-east, but, at the present stage of the country's development, there is no practicable means of getting it to market.

The northerly four miles of township 90 is all part of an enormous muskeg which extends without a break for ten miles along the Boundary, and far beyond the one and a half mile limit of exploration on either side of the Boundary. It is mostly covered with stunted spruce, varied by small tamarack, and is all wet and water-logged with no apparent surface drainage, although the levels taken prove that there is a grade of as much as twenty feet to the mile along the Boundary, and that the general drainage is towards the west. It is probable that there are one hundred square miles of unbroken muskeg in this one area.

An old Indian trail, which crosses the Boundary at its intersection with the south boundary of township 90, leads east and northeast along a ridge of high land for fifteen miles, and reaches Doig River five miles east of the Boundary. There are also old Indian trails up and down the banks of Doig River, but these were so badly obstructed by windfall that it was found necessary to cut a new trail in many places. It is twenty miles by the trail from the south boundary of township 90 to Doig River camp, although the distance is only twelve miles along the line.

Ninety chains north of the south boundary of township 90 and sixty chains west of the Boundary there is good horse feed, and a spur trail, two miles long, was cut to it. The foregoing is important because there is no other feed in any quantity between Clear Hills camp, $13\frac{1}{2}$ miles to the south, and Doig River.

Five monuments of the secondary type were established in township 90.

TOWNSHIP 91

Since the boundary between townships 90 and 91 of the Dominion Lands system of survey is a correction line, township 91 and the three succeeding townships to the north of it occupy a different position in relation to the 120th meridian from the townships lying to the south of said correction line.

In the absence of any surveyed connection (there being no Dominion Land surveys across the 120th meridian north of the 23rd Base Line) it has been calculated that the 120th meridian is about 210.50 chains west of the east boundary of Range 13 in townships 91, 92, 93 and 94.

The southerly five and a half miles of township 91 is all part of the big muskeg described above, which continues to the edge of Doig River valley.

The levels taken along the Boundary show that there is a steady fall from south to north of about twelve feet in the mile. From the above it is evident that somewhere in the ten miles of muskeg which occur in townships 90 and

91—probably near the south boundary of township 91—there is an indistinguishable height of land between Osborn and Doig Rivers.

One curious feature of the muskeg in this township is that there are two or three small islands which emerge seven or eight feet above the general level of the muskeg, and are only a few chains in diameter; these islands are covered with tall aspen and jackpine which tower above the stunted timber of the muskeg and make the islands as conspicuous as grain elevators on the prairie.

The northerly half mile of township 91 is on a gentle slope to the north, forming the southerly bank of Doig River, and is covered by aspen and jackpine up to seven inches in diameter.

Six monuments of the secondary type were established in township 91.

TOWNSHIP 92

Six chains north of township 91, the Boundary is crossed by Doig River flowing in a general westerly direction. Doig River has been fully described in Chapter 3. It is a main tributary of Beaton River, and the size and character of the river bed at the Boundary seem to indicate that it is a long way from its source, and that it must drain a much greater area to the east of the Boundary than might have been expected.

Ten chains north of the river the Boundary reaches the top of the river bank, and immediately enters upon another large muskeg area which is practically continuous to the north boundary of the township, and has a slight fall to the south and west. The above muskeg is not quite the same as that south of the river, because there are a number of islands of more or less dry ground throughout it; some of these islands are so little above the water-saturated level that they are covered with dry muskeg, while others—just a little higher—support a growth of sickly aspen and jackpine. The drier areas, however, form so small a proportion of the whole as to be negligible in determining the character of the country. About fifty per cent of the muskeg has been burned over.

Two and a half miles west of where Doig River is crossed by the Boundary, it is entered by a tributary from the north, named Adskwatim Creek, which, in its ascent, approaches the Boundary and closely parallels it for twenty-three miles.

Adskwatim Creek, where it enters Doig River, is eighteen feet wide, twelve inches deep and has a current of one mile per hour. The valley is about 30·00 chains wide and sixty feet deep, and is bordered on either side by muskeg.

There is an old Indian trail along the north bank of Doig River, from which another old trail branches up Adskwatim Creek and goes right through to Chinchaga River. Neither of the above trails has been much used for many years past, and both of them were wet in places and obstructed by windfall in others, but they afford the only practicable north and south route for horses anywhere near the Boundary and were most useful to the survey.

Five monuments of the secondary type were established in township 92.

TOWNSHIP 93

The general surface of the plateau traversed by the Boundary in township 93 is extraordinarily level, only varying between altitudes of 2490 and 2535 feet in the whole six miles.

Where the valleys of Adskwatim and tributary creeks break the general surface, and afford direct drainage, there is sound land covered with aspen and jackpine up to seven inches in diameter, but everywhere else, far beyond the one and a half mile limits of exploration on either side of the Boundary, eighty per cent of the country is covered by muskeg, the remaining twenty per cent consisting of irregular ridges (only a few feet above the muskeg level) covered with aspen and jackpine.

Adskwatim Creek is about half a mile west of the Boundary throughout township 93. The bottom of the valley is marshy, and is generally bordered by a strip of grass meadow.

Three-quarters of a mile north of township 92, and a quarter of a mile east of the Boundary, there are two little muskeg lakes from which a small creek runs southeasterly. There is good horse-feed along the creek, and a spur trail was cut one and three-quarter miles to it from the main Adskwatim trail.

Five miles north of township 92 a main tributary of Adskwatim Creek crosses the Boundary in a general westerly direction. It is five feet wide, twelve inches deep, with a current of one mile per hour, and flows in a valley fifty feet deep. The Adskwatim trail crosses the above creek fifty feet west of the Boundary. Along the south bank an Indian trail follows the creek easterly, while, on the north bank, another Indian trail strikes northeasterly. The main Adskwatim trail continues up Adskwatim Creek and was used as the survey trail. There is good feed along it.

There are active beaver colonies on nearly all the little streams in the country north of Doig River.

Six monuments of the secondary type were established in township 93.

TOWNSHIP 94

In township 94 the surface along the Boundary rises gradually from an altitude of 2530 feet on the south boundary to one of 2600 feet on the north boundary.

As in township 93, wherever Adskwatim Creek and its tributaries afford direct drainage there is a narrow belt of sound land covered with aspen and jackpine up to seven inches in diameter, but otherwise the whole country on either side of the Boundary is covered with muskeg varied by occasional willow swamps or small, isolated ridges of slightly higher ground.

Four and a half miles north of township 93 the Boundary crosses to the west side of Adskwatim Creek for the first time. Three-quarters of a mile further north, Adskwatim Creek forks, the left fork flowing from north-north-

west, and crossing the Boundary from west to east thirty chains south of township 95, while the right fork flows from the northeast in a shallow, grassy valley. Both forks are probably within six miles of their ultimate sources, and are very small.

There is a muskeg lake, about 160 acres in extent, rather more than a mile west from Monument 94-4.

Adskwatim trail follows the left fork. There is good feed all along the creek.

Five monuments of the secondary type were established in township 94.

TOWNSHIP 95

Since the boundary between townships 94 and 95 of the Dominion Lands system of survey is a correction line, township 95 and the three succeeding townships to the north of it occupy a different position in relation to the 120th meridian from the townships lying to the south of said correction line.

In township 95 the surface along the Boundary rises from an altitude of 2600 feet on the south boundary to a maximum altitude of 2627 feet at Monument 95-3, which is two and a third miles north of township 94. North from Monument 95-3 the surface falls continuously to the north boundary of the township, the altitude of which is 2533 feet.

Somewhere in the vicinity of Monument 95-3 occurs the obscure height of land between Doig and Chinchaga Rivers—i.e. between the Peace River and Hay River watershed areas.

There is a comparatively high ridge on the west side of Adskwatim Creek, covered with aspen, jackpine and spruce up to ten inches diameter, extending from one to three miles north of township 94. Otherwise the whole country on both sides of the Boundary is muskeg, varied only by large tracts of grass and willow marsh.

Adskwatim trail leaves the creek and crosses to the east side of the line about two miles north of township 94; about half a mile northeast of Monument 95-3 it forks; the left fork follows the Boundary very closely to Chinchaga River, but was found impassable for horses on account of wet muskeg; the right fork, which was used as the survey trail, strikes Chinchaga River about two and a quarter miles east of the Boundary, although it also crosses three miles of muskeg and wet grass marshes. There is fair horse-feed in the valley of Adskwatim Creek, near the south boundary, and good feed east of where the trail leaves the marshes near the north boundary of the township.

Six monuments of the secondary type were established in township 95.

TOWNSHIP 96

The surface along the Boundary in township 96 falls from an altitude of 2533 feet on the south boundary to one of 2458 feet, being the water level of Chinchaga River. North from Chinchaga River, the surface slowly rises to an altitude of 2553 feet at the north boundary of the township.

While the greater part of township 96 is covered by muskeg, there is a larger proportion of dry ridges, covered with aspen and jackpine up to seven inches diameter, than in the townships to the south of it. There are also a number of large grass and willow marshes which, though very wet, represent soil rather than moss.

Chinchaga River crosses the Boundary in a general easterly direction two miles north of township 95; it has already been fully described in Chapter 3.

Five and a half miles north of township 95 a stream ten feet wide and twenty-four inches deep, with a sluggish current, crosses the Boundary in a southeasterly direction. There are several active beaver colonies on it.

The northerly end of the Adskwatim trail used by the survey, after passing through some wet marshes in the northerly half of township 95, strikes a small creek running north, about two and a quarter miles east of the Boundary and on the south boundary of township 96; the trail then follows the above creek for a mile to its intersection with another Indian trail along the south bank of Chinchaga River, along which latter it is two and a quarter miles west to the Boundary. The survey trail to the north leaves the Chinchaga trail about half a mile east of the Boundary and, crossing the river, proceeds north and northeasterly, passing through one and a half miles of wet grass and willow swamps, to the bank of the sluggish stream described above; following the stream northwesterly it approaches close to the line five miles north of township 95, and, passing round the head of a beaver pond on the creek, reaches the line at the north boundary of the township. This part of the trail is practicable but that is all that can be said for it. There is fair feed along the north bank of Chinchaga River, and in the grass marshes along the trail.

Five monuments of the secondary type were established in township 96.

TOWNSHIP 97

At the south boundary of township 97 the altitude on the Boundary is 2553 feet, and the surface rises to an altitude of 2640 feet in the first two and a quarter miles northerly; it then rises to 2926 feet at the top of a ridge three miles north of township 96; thence it falls to 2773 feet at a small creek which crosses the Boundary in an easterly direction half a mile further north, from which it finally rises to 2953 feet on the top of a second ridge, four and a quarter miles north of township 96.

Both of the above described ridges are spurs leading easterly from a main ridge lying in a northeasterly and southwesterly direction and being about one and a half miles west of where the line crosses the most northerly of the two.

The main ridge to the west of line evidently constitutes a height of land between two important watershed areas, but, since the survey ended where it did, it is impossible to say where the area on the westerly side of it drains. It may go to another main tributary of Hay River. On the other hand it appears more probable, from information on a map of exploration issued by the British

Columbia survey office, that the streams on the other side of the ridge are headwaters of Fontas River, eventually reaching the Liard through Fort Nelson River.

The most southerly two and a quarter miles of township 97 is covered with muskeg, alternating with low ridges covered by jackpine up to six inches in diameter.

The high ridges to north and west are heavily timbered with spruce up to eighteen inches diameter, and aspen and jackpine up to twelve inches diameter.

The survey trail follows the line for thirty chains, and then turns easterly, following various small ridges and fairly dry muskegs, until it finally reaches the last camp two and a quarter miles north of township 96 and twelve chains east of the Boundary. The last camp is at the foot of higher ground and there will be no trouble in locating a packtrail to the north for some miles. No horse-feed was discovered in this township.

Five monuments of the secondary type were established in township 97, of which No. 97-5, four and a quarter miles north of township 96, marks the end of the survey conducted by the Interprovincial Boundary Commission.

APPENDIX I

REPORT ON THE SURVEY OF THE INTERPROVINCIAL BOUNDARY BETWEEN ALBERTA AND BRITISH COLUMBIA AT PHILLIPPS PASS

Phillipps Pass is a secondary pass about three miles northeast of Crowsnest Pass.

The history, origin of name and topography of Phillipps Pass are fully described on pages 60 and 61 of Part I of the Report of the Commission.

As explained on the above page 61, Phillipps Pass presents a most extraordinary case of watershed determination, and when the Boundary was surveyed through the Crowsnest area in 1914, your Commissioners were unable to come to an agreement, and the matter was set on one side for arbitration.

No further action was taken in regard to the survey of Phillipps Pass until a Conference of Representatives of the three Governments involved, was held at Edmonton in October, 1923, at which a joint proposal for a compromise survey of the disputed line was submitted by your Commissioners and approved.

The survey was made by Mr. Cautley in May 1924 and includes the survey of four courses between Monument 14-F, which was the northerly terminal point of the survey made in 1914, and Monument 22-F, which marks the northerly end of the straight-line survey of Crowsnest Pass. These are shown on the page size map included in this report.

Four monuments were established to mark the above survey. Concrete Monuments Nos. 16-F and 18-F are built on the summit of the high limestone ridge which lies between Crowsnest and Phillipps Passes and have altitudes of 5520.5 and 5951.0 feet respectively. Concrete Monument No. 20-F is built on the north edge of the small lake which occupies the middle of Phillipps Pass and has an altitude of 5156.8 feet. Bolt and Cairn Monument No. 22-F is built on a commanding point of one of the spurs of Mt. Phillipps and has an altitude of 8019 feet.

The bearings and distances between these monuments are:

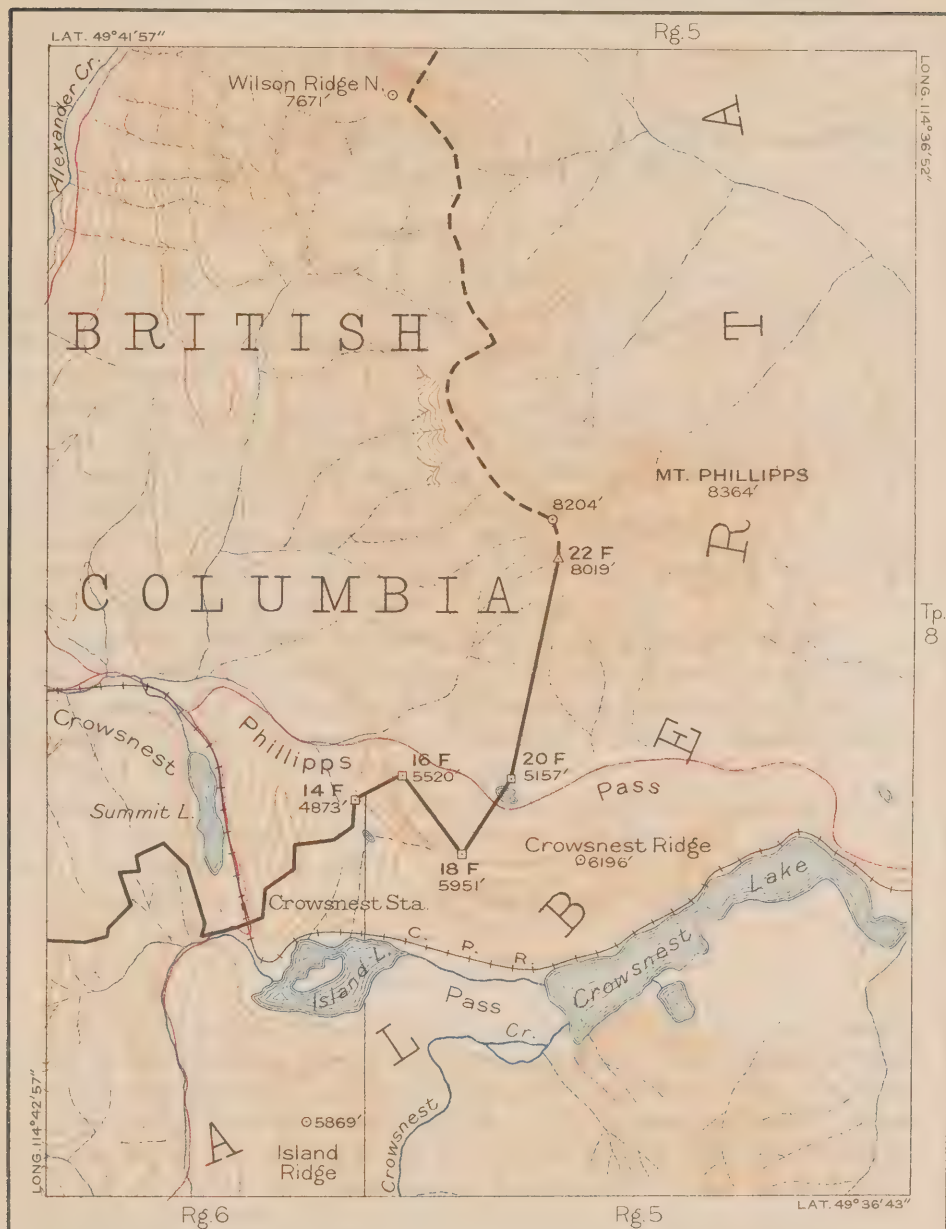
	<i>Bearing</i>	<i>Distance</i>
14F to 16F.....	63°03'35"	23.253 chains
16F to 18F.....	143°33'30"	41.430 "
18F to 20F.....	32°21'01"	38.278 "
20F to 22F.....	12°24'53"	92.638 "

The total length of straight-line boundary surveyed between Monuments Nos. 14-F and 22-F is 195.599 chains.

The above survey affects sheep sheet maps Nos. 4 and 4-A of the Atlas which accompanies Part I of the Report of the Commissioners. Referring to the above sheet maps, Monument No. 16-F occupies the position shown on sheet 4-A as "No. 3,5520' "; Monument No. 18-F is almost exactly at the point marked "No. 1,5948' "; Monument No. 20-F is on the northerly edge of the small lake lying northeasterly from "No. 1"; Monument No. 22-F occupies the position shown on sheet map 4 as having an altitude of 8036 feet on a spur of Mt. Tecumseh. It should be noted that the name shown on Sheet No. 4 as "Mt. Tecumseh" was changed by the Geographic Board of Canada to "Mt. Phillipps", after the publication of the Atlas.

INTERPROVINCIAL BOUNDARY COMMISSION

BOUNDARY BETWEEN ALBERTA AND BRITISH COLUMBIA



Scale, 1:62500

Contour interval 100 feet

Showing survey made between 14F and 22F during 1924,
completing the gap in the 1914 survey of Crow'snest Pass.

See Sheets 4 and 4A of Atlas I.

APPENDIX II

DESCRIPTION OF BRASS BOLTS AND CAIRNS PLACED TO MARK THE LINE OF THE WATERSHED

MIETTE PASS

No. 9-T.—Monument 9-T is on the watershed at the crest of the ridge separating the south and centre passages of Miette Pass, some fifteen chains northwesterly from where a spur of the ridge carries the watershed to the summit of the south passage.

The ridge is chiefly covered by shale and slabs of broken limestone rock of various sizes, and no solid bed rock was available in which to place the bolt. In consequence, a hole was drilled in the largest and most solid piece of loose rock that could be found and the brass bolt cemented in it.

The bolt was marked "Alberta and British Columbia" on the respective sides, "9-T" on both ends and "+" on top. Its altitude is 7620 feet. A cairn 5·3 feet high was erected over the bolt.

The position of the bolt and cairn is fixed by Mr. Cautley's survey.

No. 8-T.—Monument 8-T is on a bold rocky point of the watershed on the north slopes of the north passage, and is at the northerly extremity of the straight-line boundary in Miette Pass. No bed rock being available a hole was drilled in a heavy, loose rock and the bolt cemented therein.

The bolt was marked "Alberta and British Columbia" on the respective sides, "8-T" on both ends and "+" on the top. Its altitude is 7410 feet. A cairn 4·5 feet high was built over it.

The position of the bolt and cairn is fixed by Mr. Cautley's survey.

ROBSON PASS

No. 5 U.—Monument 5 U is situated on the brink of a rock escarpment which forms the northerly edge of the long slope leading up to Titkana Peak No. 1 at the northwest corner of Tatei Ridge. It is at the southerly extremity of the straight-line boundary in Robson Pass. The escarpment is very badly shattered and the bolt was cemented in a hole drilled in a piece of unstaple rock.

The bolt was marked "Alberta and British Columbia" on the respective sides, "5 U" on both ends and "+" on top. Its altitude is 7282 feet. A cairn 5·1 feet in height was erected over the bolt.

The position of the bolt and cairn is fixed by Mr. Cautley's survey of the pass summit.

No. 4^a U.—Monument 4^a U is on the top of a particularly sharply defined little summit which stands out very prominently when seen from the valley below. The summit is composed of very badly shattered limestone rock, offering no secure place to drill a hole for the bolt, so the best possible was done and the bolt cemented in the hole made. This sharp point stands out from the edge of the small snowfield on the south face of Mumm Pk.

The bolt was marked "Alberta and British Columbia" on the respective sides, "4^a U" on both ends, and "+" on top. Its altitude is 8337 feet. A cairn 5·0 feet high was erected over the bolt.

No. 6 U.—Monument 6 U is at the summit of Mumm Pk. $3\frac{1}{2}$ inches north of and in the same limestone rock as the tablet of the Geodetic Survey station. The same cairn covers the two marks.

The bolt was marked "Alberta and British Columbia" on the respective sides, "6 U" on both ends and "+" on top. A cairn 6·0 feet high was built over the bolt.

The bolt is set at the north end of the straight-line boundary in Robson Pass and is fixed in position by Mr. Cautley's survey.

APPENDIX III

TABLES OF LATITUDES AND DEPARTURES REFERRING BRASS BOLTS AND CAIRNS TO NEAREST BOUNDARY MONUMENT

(Distances are given in chains)

MIETTE PASS

No. of Bolt and Cairn	Latitude		Departure		No. of Reference Monument
	North	South	East	West	
8 T	17·054			23·648	6 T
9 T		32·597	11·211		7 T

ROBSON PASS

4 ^a U	53·470			21·027	4 U
5 U	10·262		55·796		3 U
6 U	101·532			29·248	4 U

APPENDIX IV

LIST OF ALL MONUMENTS ESTABLISHED TO MARK THE INTER- PROVINCIAL BOUNDARY BETWEEN ALBERTA AND BRITISH COLUMBIA ALONG THE 120TH MERIDIAN.

The following list shows:—

- (1) Number and nature of each monument.
- (2) Through chainage of each monument northerly from the intersection of the 120th Meridian with the summit of the Rocky Mountains, expressed in miles and showing the fractional distance beyond the nearest mile in chains and decimal fractions thereof.
- (3) The latitude of each monument, computed on the latitude values of the foregoing distances reduced to a sea-level basis, and derived from the latitude established in 1917 by the Geodetic Survey of Canada for the longitude pier at Pouce-Coupé. In order to reduce the latitudes thus computed to the same datum as all the other information published in the three parts of the Report, and on the maps, 1.25" has been added to the latitudes of the monuments deduced from the Pouce-Coupé determination, and the results are given in the columns below.
- (4) The altitude above sea-level of the top of each bolt, post or concrete monument referred to the datum of the precise level survey along Fort St. John road.

Monument	Distance Miles Chains	Latitude	Altitude
		° ' "	feet
56-0 Bolt and Cairn.....	0+ 0.000	53 47 57.47	8044.3
56-1 " ".....	1+17.146	53 49 00.66	6594.0
56-2 P. & Wit. Cairn 10'-S.	2+41.410	53 50 08.48	5262.4
56-3 Bolt and Cairn.....	5+68.485	53 53 02.20	7788.0
57-1 " ".....	7+62.931	53 54 42.66	6963.4
57-2 " ".....	8+36.252	53 55 17.34	6806.0
58-1 Number omitted.			
58-2 P. T. M.	14+64.797	54 00 48.12	6040.7
58-3 " ".....	15+38.008	54 01 22.73	6143.3
59-1 Bolt and Cairn.....	19+20.783	54 04 39.66	7170.0
59-2 " ".....	22+39.511	54 07 27.95	4848.6
60-S " ".....	24+65.701	54 09 29.06	6688.0
60-0 " ".....	25+57.192	54 10 15.56	7348.0
60-1 " ".....	26+27.553	54 10 48.31	7678.0
60-2 " ".....	27+27.403	54 11 40.24	7353.5
60-3 " ".....	30+42.458	54 14 26.13	6135.4
61-1, 61-2 and 61-3 omitted.			
61-4 Bolt and Cairn.....	33+70.943	54 17 20.76	6550.0
61-5 P. & Stone Mound.....	34+73.159	54 18 14.25	6357.0

Monument	Distance Miles Chains	Latitude	Altitude
		° ' "	feet
62-1 P. and Stone Mound.....	36+54.093	54 19 45.93	5441.0
62-2 P. T. M.....	37+53.904	54 20 37.55	3222.3
62-3 Concrete Monument.....	38+22.596	54 21 09.52	3744.7
62-4 P. T. M.....	39+12.601	54 21 55.06	3893.6
62-5 ".....	40+09.326	54 22 44.97	4163.3
62-6 Concrete Monument.....	41+35.258	54 23 53.88	4361.5
62-7 P. T. M.....	42+41.586	54 24 50.03	4426.9
63-1 Number omitted.			
63-2 P. T. M.....	43+18.098	54 25 26.79	4290.5
63-3 ".....	42+76.961	54 26 05.08	4469.3
63-4 ".....	45+25.673	54 27 15.79	4651.8
63-5 ".....	46+16.535	54 28 01.88	5071.9
63-6 P. Stone Mound.....	46+77.880	54 28 41.78	5191.5
63-7 Concrete Monument.....	48+20.404	54 29 48.47	4892.8
64-1 P. T. M.....	49+03.821	54 30 29.72	4479.6
64-2 ".....	49+62.835	54 31 08.10	4207.0
64-3 ".....	50+73.159	54 32 06.86	4242.3
64-4 ".....	51+69.607	54 32 56.59	4016.1
64-5 ".....	52+68.320	54 33 47.79	3889.7
64-6 ".....	53+60.347	54 34 34.64	3774.9
65-1 Concrete Monument.....	54+57.575	54 35 24.87	3851.9
65-2 P. T. M.....	55+65.798	54 36 22.25	3839.0
65-3 ".....	56+36.394	54 36 55.16	3871.2
65-4 ".....	57+41.138	54 37 50.28	3913.8
65-5 Concrete Monument.....	58+65.416	54 38 58.11	4382.2
65-6 P. T. M.....	59+16.812	54 39 18.53	4008.8
65-7 ".....	60+37.787	54 40 24.21	3492.8
66-1 ".....	61+59.030	54 41 30.07	3720.1
66-2 ".....	62+79.248	54 42 35.26	3107.8
66-3 P. T. (No M.).....	64+25.662	54 43 44.48	2946.7
66-4 Concrete Monument.....	64+64.398	54 44 09.68	2518.1
66-5 " ".....	65+25.516	54 44 36.43	3016.8
66-6 " ".....	65+69.697	54 45 05.17	3183.1
67-1 " ".....	66+65.197	54 45 54.28	3241.4
67-2 " ".....	67+48.399	54 46 35.39	3485.2
67-3 " ".....	68+41.402	54 47 22.87	3305.5
67-4 " ".....	69+25.319	54 48 04.44	3210.7
67-5 " ".....	70+55.051	54 49 15.81	3134.1
67-6 P. T. M.....	72+11.526	54 50 31.57	3103.7
68-1 Concrete Monument.....	73+34.637	54 51 38.63	3142.6
68-2 " ".....	74+55.140	54 52 44.00	3425.7
68-3 " ".....	75+58.322	54 53 38.11	3417.6
68-4 " ".....	76+52.806	54 54 26.56	3332.7
68-5 " ".....	78+07.466	54 55 41.14	3136.5
69-1 " ".....	78+67.180	54 56 19.98	3036.5
69-2 " ".....	79+67.785	54 57 12.41	3028.1
69-3 " ".....	81+10.447	54 58 19.19	2936.1
69-4 " ".....	81+61.523	54 58 52.41	2913.0
69-5 " ".....	82+63.837	54 59 45.95	2903.8
69-6 " ".....	83+77.878	55 00 47.12	2890.3
69-7 " ".....	84+44.112	55 01 17.19	2880.3
70-1 " ".....	85+35.112	55 02 03.37	2844.0

Monument		Distance Miles Chains	Latitude	Altitude
			° ' "	feet
70-2	Concrete Monument.....	86+08.781	55 02 38.28	2861.8
70-3	" ".....	86+79.398	55 03 24.21	2834.4
70-4	" ".....	87+41.071	55 03 51.32	2845.6
70-5	" ".....	88+62.417	55 04 57.24	2787.5
70-6	" ".....	89+30.693	55 05 28.64	2787.7
70-7	" ".....	90+54.573	55 06 36.21	2838.0
71-1	" ".....	91+46.715	55 07 23.13	2900.8
71-2	" ".....	92+64.255	55 08 26.57	2903.8
71-3	" ".....	93+76.968	55 09 26.87	2907.0
71-4	" ".....	94+64.417	55 10 10.74	2841.0
71-5	" ".....	95+62.732	55 11 01.68	2873.8
71-6	" ".....	96+47.412	55 11 43.75	2835.8
72-1	" ".....	97+49.619	55 12 37.22	2806.4
72-2	" ".....	98+42.541	55 13 24.65	2830.7
72-3	" ".....	99+39.958	55 14 15.00	2815.2
72-4	" ".....	100+33.256	55 15 02.67	2882.8
72-5	" ".....	101+44.710	55 16 02.15	2857.6
72-6	" ".....	102+66.573	55 17 08.40	2896.0
73-1	" ".....	103+74.831	55 18 05.80	2925.4
73-2	" ".....	105+08.626	55 19 06.81	2945.3
73-3	" ".....	105+43.959	55 19 29.78	2951.5
73-4	" ".....	106+10.255	55 19 59.89	2909.9
73-5	" ".....	107+25.422	55 21 01.79	2771.9
73-6	Number omitted.			
73-7	Concrete Monument.....	108+59.348	55 22 15.85	2882.2
74-1	" ".....	109+40.753	55 22 55.85	2889.8
74-2	" ".....	110+21.761	55 23 35.55	2864.4
74-3	" ".....	111+20.448	55 24 26.65	2879.2
74-4	" ".....	111+68.895	55 24 58.15	2909.6
74-5	" ".....	112+62.051	55 25 45.75	2923.3
74-6	" ".....	113+70.953	55 26 43.55	2935.2
74-7	" ".....	114+41.507	55 27 16.45	2947.7
74-8	" ".....	114+72.832	55 27 36.85	2876.9
75-1	" ".....	116+16.173	55 28 44.15	2489.1
75-2	" ".....	117+08.133	55 29 30.95	2479.7
75-3	" ".....	117+66.462	55 30 08.85	2438.4
75-4	" ".....	118+72.618	55 31 04.45	2659.7
75-5	" ".....	119+72.438	55 31 56.65	2390.0
76-1	" ".....	121+08.166	55 32 59.05	2438.7
76-2	" ".....	121+77.009	55 33 43.85	2687.0
76-3	" ".....	122+38.725	55 34 10.95	2579.3
76-4	" ".....	123+40.584	55 35 04.25	2465.2
76-5	" ".....	124+38.462	55 35 54.85	2519.9
76-6	" ".....	125+10.365	55 36 28.65	2559.1
76-7	" ".....	126+02.022	55 37 15.25	2616.7
77-1	" ".....	127+07.747	55 38 10.95	2692.4
77-2	" ".....	127+67.563	55 38 49.85	2551.2
77-3	" ".....	128+49.225	55 39 30.05	2271.9
77-4	" ".....	129+30.633	55 40 09.95	2290.6
77-5	" ".....	130+31.604	55 41 02.55	2472.8

Monument	Distance Miles Chains	Latitude	Altitude
		° ' "	ft.
77-6 Concrete monument.....	131+04.958	55 41 37.25	2340.5
77-7 " ".....	132+05.128	55 42 29.45	2305.4
78-1 " ".....	133+11.861	55 43 25.85	2344.7
78-2 " ".....	134+27.294	55 44 27.95	2585.1
78-3 " ".....	135+64.037	55 45 43.85	2303.0
78-4 " ".....	137+03.146	55 46 48.25	2154.4
78-5 " ".....	138+25.984	55 47 55.15	2133.8
79-1 " ".....	139+14.046	55 48 39.45	2148.3
79-2 " ".....	139+75.101	55 49 19.15	2138.8
79-3 " ".....	140+51.531	55 49 55.85	2114.6
79-4 " ".....	141+58.065	55 50 52.15	2068.1
79-5 " ".....	143+01.586	55 51 59.45	2060.5
79-6 " ".....	143+65.952	55 52 41.35	2062.6
79-7 " ".....	144+49.108	55 53 22.45	2081.1
80-1 " ".....	145+46.583	55 54 12.75	2071.9
80-2 " ".....	146+55.880	55 55 10.85	2101.2
80-3 " ".....	147+70.380	55 56 12.35	2093.6
80-4 " ".....	148+38.577	55 56 43.65	2085.2
80-5 " ".....	149+38.608	55 57 35.75	2078.9
80-6 " ".....	150+31.669	55 58 23.25	2097.5
80-7 " ".....	151+03.710	55 58 57.05	2110.0
81-1 " ".....	152+23.061	56 00 01.65	2107.9
81-2 " ".....	153+08.182	56 00 44.05	2116.0
81-3 " ".....	153+79.127	56 01 30.15	2119.8
81-4 " ".....	155+19.162	56 02 35.25	2072.7
81-5 " ".....	156+16.190	56 03 25.35	2092.5
81-6 " ".....	156+79.977	56 04 06.75	2078.7
82-1 " ".....	158+07.863	56 05 03.95	2031.1
82-2 " ".....	159+21.205	56 06 04.65	1997.9
82-3 " ".....	160+22.235	56 06 57.45	2003.0
82-4 " ".....	160+72.886	56 07 30.35	1958.8
82-5 " ".....	161+76.037	56 08 24.35	1758.1
82-6 " ".....	162+41.829	56 08 54.15	1345.0
82-7 " ".....	162+64.434	56 09 08.85	2012.7
83-1 " ".....	164+05.845	56 10 14.85	2082.0
83-2 " ".....	165+20.686	56 11 16.55	2111.8
83-3 " ".....	166+01.128	56 11 55.85	2135.0
83-4 " ".....	166+60.392	56 12 34.35	2145.0
83-5 " ".....	168+11.738	56 13 46.75	2280.7
83-6 " ".....	168+58.830	56 14 17.45	2304.8
84-1 " ".....	169+74.234	56 15 19.45	2350.4
84-2 " ".....	170+62.239	56 16 03.65	2443.0
84-3 " ".....	172+23.806	56 17 22.75	2450.0
84-4 " ".....	173+47.381	56 18 30.05	2425.3
84-5 " ".....	174+39.104	56 19 16.75	2407.0
85-1 P. T. M.....	176+75.559	56 21 24.45	2409.1
85-2 " ".....	178+29.544	56 22 38.55	2423.3
85-3 " ".....	179+05.414	56 23 14.85	2463.0
85-4 " ".....	179+72.345	56 23 58.35	2479.4
85-5 " ".....	181+14.434	56 25 04.75	2476.5
86-1 " ".....	182+67.305	56 26 31.25	2503.7
86-2 " ".....	183+66.952	56 27 23.05	2551.0

Monument	Distance Miles Chains	Latitude	Altitude
		° ' "	ft.
86-3 P. T. M.	184+53.538	56 28 06.35	2618.1
86-4 "	185+72.020	56 29 10.45	2683.5
86-5 "	186+75.346	56 30 04.65	2784.2
87-1 "	187+41.377	56 30 34.55	2831.5
87-2 "	188+43.959	56 31 28.25	2898.2
87-3 "	189+66.972	56 32 35.25	2865.8
87-4 "	191+04.327	56 33 38.55	2875.7
87-5 "	191+46.283	56 34 05.85	2916.4
87-6 "	192+70.082	56 35 13.35	3016.6
88-1 "	194+02.298	56 36 13.35	2993.0
88-2 "	195+09.254	56 37 09.85	3012.7
88-3 "	196+16.991	56 38 06.95	3306.0
88-4 "	197+28.283	56 39 03.05	2979.5
88-5 "	198+48.346	56 40 11.35	2988.5
88-6 "	199+39.483	56 40 57.65	2980.7
89-1 "	200+07.613	56 41 28.95	2991.9
89-2 "	201+06.358	56 42 20.15	2873.8
89-3 "	202+31.916	56 43 28.75	2841.4
89-4 "	203+32.447	56 44 21.15	2771.9
89-5 "	204+70.236	56 45 37.75	2565.1
90-1 "	205+65.607	56 46 26.75	2560.8
90-2 "	206+58.703	56 47 14.25	2543.2
90-3 "	207+72.227	56 48 15.05	2506.5
90-4 "	209+10.745	56 49 19.15	2524.5
90-5 "	210+31.231	56 50 24.45	2526.6
91-1 "	211+57.750	56 51 33.75	2517.7
91-2 "	212+54.770	56 52 23.85	2499.5
91-3 "	213+69.216	56 53 25.25	2471.0
91-4 "	214+50.291	56 54 04.95	2462.7
91-5 "	215+54.424	56 54 59.65	2450.8
91-6 "	216+48.441	56 55 47.85	2438.0
92-1 "	217+63.279	56 56 49.55	2398.7
92-2 "	219+10.034	56 57 58.95	2429.9
92-3 "	220+22.324	56 58 58.95	2448.9
92-4 "	221+27.099	56 59 54.05	2472.8
92-5 "	222+25.919	57 00 45.35	2487.5
93-1 "	223+62.919	57 02 01.45	2490.5
93-2 "	224+54.556	57 02 48.05	2504.2
93-3 "	225+62.388	57 03 45.15	2517.3
93-4 "	227+04.146	57 04 51.35	2525.8
93-5 "	228+01.313	57 05 41.55	2519.8
93-6 "	229+06.949	57 06 37.25	2542.1
94-1 "	230+05.469	57 07 28.25	2537.2
94-2 "	231+48.001	57 08 47.85	2541.4
94-3 "	232+63.313	57 09 49.85	2567.5
94-4 "	233+61.712	57 10 40.85	2539.4
94-5 "	235+09.334	57 11 50.85	2593.8
95-1 "	235+72.671	57 12 32.05	2591.7
95-2 "	237+04.920	57 13 32.05	2602.0
95-3 "	238+02.847	57 14 22.75	2627.5

Monument	Distance Miles Chains	Latitude	Altitude
		° ' "	ft.
95-4 P. T. M.	239+22.428	57 15 27.45	2562.0
95-5 "	240+34.900	57 16 27.55	2541.6
95-6 "	241+56.905	57 17 33.85	2533.1
96-1 "	242+57.860	57 18 26.45	2506.4
96-2 "	243+74.248	57 19 29.15	2479.6
96-3 "	245+35.234	57 20 47.85	2501.4
96-4 "	246+52.309	57 21 50.95	2551.2
96-5 "	247+50.855	57 22 42.05	2552.8
97-1 "	248+60.556	57 23 40.35	2600.1
97-2 "	249+53.611	57 24 27.85	2627.6
97-3 "	250+26.225	57 25 02.05	2688.5
97-4 "	250+67.558	57 25 28.95	2926.3
97-5 "	252+17.482	57 26 40.25	2953.3



CAIRN ON THE SUMMIT OF TORRENS

MONUMENTS "F"—CROWS NEST PASS



5 F, after 10 years



5 F



5 F



5 F



16 F



18 F



18 F



20 F



20 F

MONUMENTS "U"—ROBSON PASS



22 F



1 U, MEMORIAL



3 U

MONUMENTS "U" - ROBSON PASS MONUMENTS "T" - MIETTE PASS



5 U



2 U



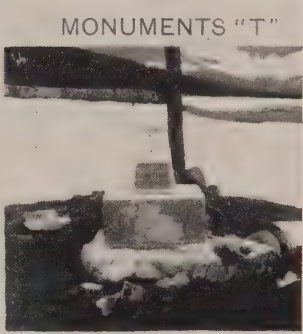
4 U



4 A U



6 U



MONUMENTS "T"

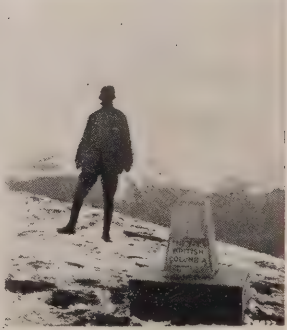
1 T



3 T



5 T



7 T



7 T



9 T



11 T

MONUMENTS "T" - MIETTE PASS



2 T



4 T



CHINCHAGA RIVER

MONUMENTS - 120th MERIDIAN



56-0



56-1



56-2



56-3



57-2



58-2



58-3



59-1

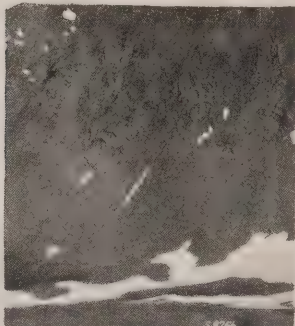


59-2

MONUMENTS—120th MERIDIAN



60-0



60-1



60-2



60-3



60-5



61-4



61-4



62-1



62-3



62-6

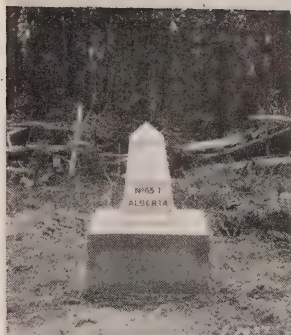


63-6



63-7

MONUMENTS—120th MERIDIAN



65-1



65-5



66-4



66-5



66-6



67-1



67-2



67-3



67-4



67-5



67-6



68-1

MONUMENTS—120th MERIDIAN



68-2



68-3



68-4



68-5



69-1



69-2



69-3



69-4



69-5



69-6

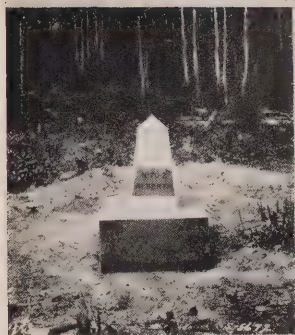


69-7



70-1

MONUMENTS—120th MERIDIAN



70-2



70-3



70-4



70-5



70-6



70-7



71-1



71-2



71-3



71-4



71-5



71-6

MONUMENTS—120th MERIDIAN



72-1



72-2



72-3



72-4



72-5



72-6



73-1



73-2



73-3



73-4

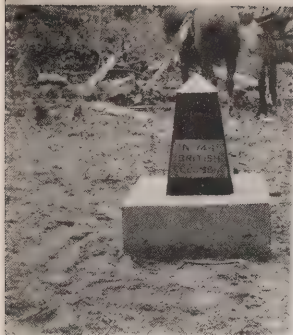


73-5



73-7

MONUMENTS - 120th MERIDIAN



74-1



74-2



74-3



74-4



74-5



74-6



74-7



74-8



75-2



75-3



75-4



75-5

MONUMENTS—120th MERIDIAN



76-1



76-2



76-3



76-4



76-5



76-6



76-7



77-1



77-2



77-3



77-4



77-5

MONUMENTS—120th MERIDIAN



77-6



78-1



80-1



80-2



80-3



80-4



80-5



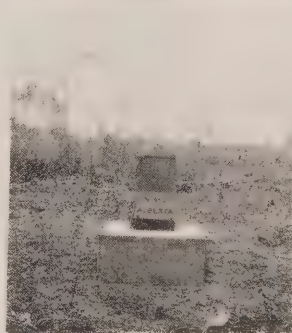
80-6



80-7



81-1



81-2



81-3

MONUMENTS—120th MERIDIAN



81-4



81-5



81-6



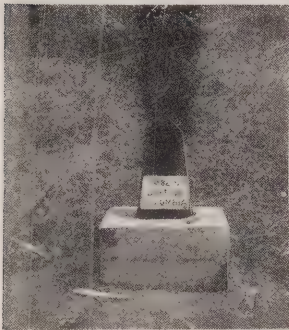
82-1



82-2



82-4



82-5



82-6



82-7



83-1

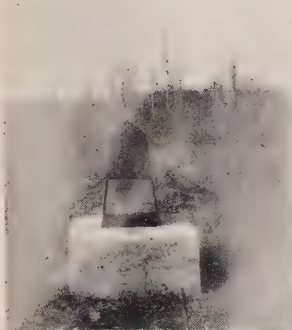


83-2



83-3

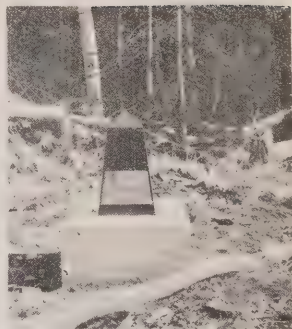
MONUMENTS—120th MERIDIAN



83-4



83-5



83-6



84-1



84-2



84-3



84-4



84-5



Line in Tp. 68



Line in Tp. 68



88-3



97-5

INDEX

	PAGE		PAGE
Act defining boundary.....	83	Beavertail creek.....	145
Adolphus lake.....	18, 27, 29, 74, 78	Belcourt creek.....	134, 138
Adskwatim		Berg	
Creek.....	121, 166, 167, 168	Glacier.....	18, 29
Trail.....	167, 168	Lake.....	17, 18, 27, 29, 74, 78
Aerial photos.....	3, 4, 16, 21	Bess	
Airplane.....	2, 3	Mt. .3, 5, 6, 20, 22, 25, 28, 36, 37, 44, 45	
Air Service station.....	2	Pass. .2, 6, 20, 21, 28, 30, 31, 33, 34, 35,	
Alexander Mt. Sir.....	3, 4, 66, 129	36, 37, 45, 51, 58	
Alpine Club.....	6, 16, 31, 77, 78, 79	Pass SE. camera station.....	23, 44, 47
Alpine Journal.....	17, 20	Pass SW. camera station.....	23, 44, 47
Alpland camera stations.....	45, 47	Pass W. No. 1 camera station.....	47
American Geographical Society.....	36	Pass W. No. 2 camera station.....	47
Annapolis, U.S.....	126	Shoulder camera station.....	47
Appendix I		Big Horn.....	73
Report on the survey of Phillipps pass. .	171	Big Shale hills.....	34, 71
Appendix II		Biff camera station.....	11
Description of brass bolts and cairns. .	173	Black Point.....	157
Appendix III		Blair camera station.....	68
Tables of latitudes and departures of		Shoulder camera station.....	68
reference points.....	175	Boundary lake.....	118, 159, 160
Appendix IV		Boundary by Act.....	83
Distances, latitudes and altitudes of		Bowlen camera station.....	62
monuments on 120th Meridian.....	177	Bridgland Mt.....	11
Appendix V		British Columbia surveys.....	150
Views of monuments		Broadview	
Crowsnest (Phillips) pass.....	183	Lake.....	64
Robson pass.....	183	Mtn.....	64, 65, 68
Miette pass.....	184	Mtn. camera station.....	68
120th meridian.....	185	Buchanan.....	64, 65
Astronomical observations.....	92	Butterfly camera station.....	62
Athabaska		"C" camera station.....	70
Town.....	103	Caches.....	109
River.....	2, 28, 50, 103	Calahoo	
Avalanche		Creek.....	142
Camera stations.....	42, 49	Lake.....	113, 142
Creek.....	40, 41, 49	Trail.....	115, 138, 141, 142
Pass.....	34, 38, 40, 41, 49	Calumet	
Banff.....	1, 6	Creek and valley . .6, 13, 15, 20, 26, 28, 29, 75	
Barricade Shoulder camera station.....	47	Peak.....	14
Base line N. camera station.....	70	Ridge.....	15
Bases.....	1, 33, 58, 93, 94	West camera station.....	15
Bastille		Camera stations	
Creek.....	63, 64, 66	Bess pass.....	6, 23, 24
Mt.....	64	Calumet creek.....	6, 15
Mt. Camera station.....	68	Carcajou creek and pass.....	6, 23
Beaton river.....	119	Chown creek and valley of Bess pass..	5, 44
Beaupre		Colonel pass.....	5, 12
Camera station.....	11	Fetherstonhaugh pass.....	35
Mt.....	11	Holmes river valley.....	44, 45
Beaver.....	114, 122, 158	Jackpine pass.....	36
Beaverdam		Jackpine pass to Loren Lake pass.....	47
Creek.....	40, 49	Loren lake to Avalanche pass.....	50
Overlook camera station.....	50	Loren Lake pass.....	34
Pass.....	34, 38, 40, 43, 48, 49	Miette pass.....	5, 11
Beaverlodge		Moose pass.....	5, 15
Lake.....	147, 148	Moose river valley.....	35
River.....	147, 148	Morkill pass to Sheep pass.....	62
Station.....	199	Muddywater river.....	34

Index

	PAGE		PAGE
Camera stations (<i>concluded</i>)		Coal	107, 114
North of Kawa river	69	Coal	
Of 1911	7	Creek	99
Of 1921	7, 8	Ridge camera station	68, 69
Sheep pass	59	Cockle camera station	68
Sheep pass to Kakwa valley	68	Coleman	
Smoky river valley	6	Glacier	26
Campbell's passes	8	Colonel	
Campion creek	13	Creek	5, 8, 11
Canadian National railway	2, 16, 27, 28, 30	Mt.	2, 11, 12, 13, 14
51, 77, 103.		Pass	5, 11, 12, 25, 34, 51, 75
Canadian Northern railway	27	Pass E. camera station	12
Canadian Pacific railway	85	Pass N. camera station	12
Carcajou		Pass S. camera station	12
Creek	6, 22, 24, 28, 29, 34, 43, 54	Peak 11	11
Creek N. camera station	23, 44	Compass hill	134, 136
Pass	22, 23, 34, 35, 36, 43, 53	Conferences	89, 90, 110, 124, 171
Pass W. camera station	44	Copton camera station	68
Pass valley	53	Cote	
Caribou	72, 114, 130	Creek	65, 72
Casket		Mt.	65, 71, 128
Creek	46, 60, 61	Mt. camera station	68
Mt.	61, 62	Courier camera station	50
Mt. camera station	62	Creche camera station	68
Pass	58, 60, 61, 62, 63, 71	Creche shoulder camera station	68
Pass camera station	62	Crescent camera station	62
N. camera station	62	Cutting on line	93
Cecil lake	162	Crowsnest pass	171
Cecil lake trail	162		
Cecilia		Deer	114, 122, 130
Creek	64, 66, 72	Definition of boundary	83
Lake	64, 65, 71, 128, 130	Departure peak camera station	68
N. camera station	68	De Veber	
W. camera station No. 1	68	Mt.	33, 35
W. camera station No. 2	68	Camera station	62
Centre camera station	11	Diagrams of monuments	95, 96
Chainage measurements	92, 93, 102	Dinosaur	
Chaining tripod	92	Creek	72
Chalco		Ridge	129, 131
Creek and valley	39, 46, 47, 48	Direction of line	92
Mt.	46, 47	Doe creek	155, 156
Mt. camera station	47	Doig river	117, 119, 120, 121, 123, 165, 166, 168.
Cheval		Dominion Lands Surveys	1, 33, 57, 94, 97, 101, 102, 108, 112, 141, 143, 145, 149, 150, 153, 157, 158, 159, 162, 164, 165, 168.
Hill	71	Draco peak camera station	47
Camera station	68	Dunvegan	88, 161
Chinchaga river	119, 121, 122, 123, 168, 169		
Chinook		Edmonton	88, 90, 104, 108, 114, 117, 124
Creek	137, 138, 139	Edson trail	103
Ridge	137, 138	Elevations	
Chown		All monuments on 120th Meridian 177 to 182	
Creek	6, 20, 21, 22, 28, 37, 44, 51	A pass NW. of Cecilia lake	71
Creek N. camera station	23, 47	At Calumet creek	14
Creek S. camera station	23	Avalanche pass	41
E. camera station	23	Based on precise levels	16
Glacier	28, 30, 37, 38, 44, 45	Bastille Mt.	87
Mt.	20, 21, 22, 23, 36, 38	Beaverdam pass	41
S. No. 1 camera station	44	Bess Mt.	5, 20, 21, 44
S. No. 2 camera station	44	Bess pass	21
Chronograph	87	Between Steeprock creek and Beaver-	
Chutes at Vermilion	104	lodge river	147
Clear		Between Crowsnest and Phillipps pass	171
Hills	119, 136, 144, 162, 163, 164, 165		
River	161, 162, 163		
Closing errors	125, 126, 127		

Index

	PAGE		PAGE
Elevations (<i>continued</i>)		Elevations (<i>continued</i>)	
Of boundary in		Loren pass.....	39
Township 56.....	71	Miette pass	
63.....	105	Centre.....	76
64.....	136	North.....	76
65.....	136, 154	South.....	76
66.....	139	Kakwa Mt.....	128
68.....	143	Monuments on 120th Meridian in	
69.....	144	Township 56.....	71, 128, 177
72.....	146	57.....	128, 177
73.....	105	58.....	177
74.....	148	59.....	71, 177
76.....	150	60.....	129, 177
77.....	151, 152	61.....	129, 177
78.....	152, 153	62.....	132, 178
79.....	153	63.....	134, 178
80.....	155	64.....	178
82.....	156	65.....	178
85.....	160	66.....	178
86.....	161	67.....	178
87.....	162	68.....	178
89.....	164	69.....	178
91.....	165	70.....	178
95.....	168	71.....	178
96.....	168	72.....	178
97.....	169	73.....	105, 178
Buchanan Mt.....	64	74.....	178
Camera stations at Grant pass.....	11	75.....	179
Colonel pass.....	12	76.....	179
Bess pass.....	23, 44	77.....	180
Carcajou pass.....	23	78.....	180
Holmes river area.....	44	79.....	180
Jackpine pass area.....	47	80.....	180
Loren lake to Avalanche pass.....	50	81.....	180
Moose pass and Calumet creek.....	15	82.....	156, 180
Morkill pass to Sheep pass.....	62	83.....	180
North of Kakwa river.....	69	84.....	180
Sheep pass to Kakwa valley.....	68	85.....	160, 180
Calumet peak.....	14	86.....	180, 181
Carcajou pass.....	23	87.....	181
Casket pass.....	61	88.....	181
Carried by Trigonometrical methods.....	16	89.....	181
Casket pass.....	61	90.....	181
Centre pass (Miette).....	76	91.....	181
Chown Mt.....	5, 21	92.....	181
Clear hills.....	119	93.....	181
Colonel Mt.....	12	94.....	181
Colonel pass.....	11	95.....	181, 182
Compass hill.....	134	96.....	182
Côte Mt.....	65	97.....	182
Fetherstonhaugh pass.....	59, 71	Mumm peak.....	75
Forgetmenot pass.....	59, 60, 71	Moose pass.....	13
Gendarme Mt.....	23	Morkill pass.....	71
Gorman Mt.....	69	Narraway river at Boundary crossing.....	139
Grant pass.....	11	North pass (Miette).....	76
Holmes Mt.....	45	Pass between Wallbridge and Boradview	
Ida Mt.....	66	Mts.....	64
Intersection Mt.....	57	Pauline Mt.....	41, 48
Jackpine Mt.....	45	Perseverance Mt.....	46
Jackpine pass.....	45	Phillipps Mt.....	23, 44
Jones pass.....	40	Phillipps pass.....	171
Kakwa lake.....	65	Precise level work.....	16, 127, 149
pass.....	69	Robson Mt.....	3, 16, 75
Mt.....	128	Saxon creek valley.....	69
Longstaff Mt.....	23	Sheep pass.....	62

Index

	PAGE		PAGE
Elevations (<i>concluded</i>)		Grand Fork of the Fraser	16, 29
Sir Alexander Mt.	66	Grand Trunk Pacific	16, 27, 103
South boundary Tp. 63	134	Grande Paririe	99, 100, 107, 108, 110, 124
South pass (Miette)	76	Grant	
Steeprock creek to Beaverlodge river	147	Brook	5, 7, 8, 9, 24, 28, 55, 76
Swan lake	149	Pass	5, 10, 11, 25, 26, 27, 75
Timber line near Mt. Torrens	72	Pass camera stations	11, 13, 25
Torrens Mt.	115	Pass valley	11
Trigonometrical level work	127	Great Shale Hill	51, 71
Wallbridge Mt.	64	Greys camera station	13
Wapiti river			
At southerly crossing 120th Meridian	139	Hanington	
northerly crossing 120th Meridian	139	Creek	69, 70, 72
the Forks	139	Pass	68, 69
Whiteshield Mt.	45	Pass camera stations	69, 70
Emperor falls	17	Hank camera station	62
Emperor's leap	17	Hay river and valley	118, 119, 123, 168
Executive Councils	91	Henderson	
Exploration of 1921	7	Creek	154, 155
Extinguisher	27	River	154
Ewan camera station	62	Henry house	2
		Herd and Herd Shoulder camera stations	70
"F" camera station	70	Hiding creek	114, 142
"F" shoulder camera station	70	High river	2
Fall of the Pool	18	Holmes camera station	34
Fetherstonhaugh		Mt.	45, 47
Creek	42, 60	Mt. camera station	47
Mt. No. 1 camera station	62	N. camera station	47
Mt. No. 2 camera station	62	River	21, 22, 27, 30, 34, 36, 43, 44, 45, 46, 47, 48, 49, 53
Pass	35, 59, 60	River valley	34, 36, 44, 45
West No. 1, camera station	62	Valley overlook camera station	45
West No. 2, camera station	62	Valley west camera station	45
Findlay river	104	Horn ridge camera station	70
Fish	30, 54, 72	Howse pass	85
Flume creek	131	Hudson's Bay Company	19, 117
Forget		Hughes camera station	48, 50
Mt. No. 1 camera station	62	Huguenot creek	114, 134, 136, 137
Mt. No. 2 camera station	62	Huwino camera station	70
Forgetmenot			
Creek	60, 61	Ida Mt.	3, 66, 129
Pass	59, 60, 71	Imperial Act defining boundary	83
Fort Nelson river	170	Initial point on 120th Meridian	99, 100, 102, 152
Fort St. John	99, 100, 127, 148, 150, 159, 160, 161, 162	Instructions for surveys	90
Fort Vermilion	104, 124	Interprovincial boundary—definition	83
Fraser		Interpass	
Pass	28	Camera stations	49, 50
River	7, 13, 19, 27, 28, 29, 30, 43, 52, 64, 67	Ridge	42
Valley	6, 13, 27, 35, 51, 52	Intersection	
Fritton lake	109, 146, 147	Mt.	57, 61, 70, 127
Game	30, 54, 72, 73, 114, 123, 130	Mt. camera station	62
Gendarme Mt.	23		
"G" east camera station	70	"J" camera station	69
"G" west camera station	70	Jackpine	
Geodetic Survey	1, 2, 16, 33, 34, 35, 58, 77, 86, 87, 88, 100, 125, 126, 127	Camera stations	45, 47, 48
Geographic Board	3, 22, 29, 112, 121, 134	Mt.	45
Geological Survey	16	Pass	2, 6, 34, 35, 37, 45, 47
Ginger camera station	13, 26	River	36, 39, 40, 45, 46, 52, 53
Good Luck camera station No. 1 and No. 2	70	River valley	2, 22, 36, 37, 38, 40, 45, 51, 54
Gorman Creek	68, 69, 71, 72	Jarvis	
Mt.	68, 69	Creek	66, 67
Mt. No. 1 and No. 2 camera stations	69	Pass	2, 3, 33, 65, 66, 67, 69, 71, 128
Graham creek	146		

Index

	PAGE
Jasper	
Station.....	6, 28, 33, 35, 50, 58, 71, 77
Park.....	2, 27, 50
Jessie Mt. camera station.....	23, 44
Jobe-Phillips map.....	36, 38, 40
Jobe Miss.....	36, 67
Jones—	
Pass.....	34, 40, 50
Pass camera stations.....	50
Kakwa	
Camera stations.....	69
Lake.....	65, 66, 67, 68
Mt.....	128
Pass.....	64, 65, 66, 67, 68, 70
River.....	64, 67, 69, 70, 72, 128, 129
Valley.....	66, 67, 68, 69, 70, 129
Kemel station.....	11
Kicking Horse pass.....	85, 108
Kinney	
Lake.....	16, 29
Kiskatinaw river.....	99
La Creche	
Mt.....	68, 130
Mt. camera stations.....	68
Latitude.....	88, 126, 177 to 182
Lattice creek.....	109, 144
Laussedat Col. A.....	11
Levelling	
Check levels.....	102, 127
Datum for.....	16, 93
Descriptions.....	93, 102, 118, 127, 150
Initial point of spirit levels.....	101
Mileages.....	93, 127
Precise.....	16, 93, 101, 127, 150
Spirit.....	93, 101, 102, 127, 149, 150
Trigonometrical.....	16, 93, 102, 127
Ties and closings.....	101, 102, 149
Liard river.....	104, 170
Longitude.....	58, 86, 87, 88, 99, 100, 126, 152, 177
Longstaff Mt.....	23, 43
Loren	
Camera stations.....	46
Lake.....	38, 47
Pass.....	34, 39, 41, 47, 48, 49
Lynx Mt. and camera station.....	25, 26
Machray Mt.....	10, 25
Mackenzie river.....	104
Magnetic declinations.....	94
Maps.....	7, 31, 36, 55, 74
May Mt. camera station.....	68
McCord Mt. and camera stations.....	11, 12, 25
McNaughton Mt. and camera stations.....	11
Meadowland	
Creek.....	38, 46, 51
Valley.....	38
Measurement of distances.....	92, 93, 98, 101
Memorial monument.....	77, 78
Merlin creek.....	156

	PAGE
Methods of survey.....	91 to 98
Miette	
Camera stations.....	11
Lake.....	9, 31
Pass.....	5, 7, 8, 9, 24, 26, 27, 51, 58, 59, 74, 75, 76, 86, 91, 124, 173, 175, 184
River.....	7, 9, 10, 24, 28, 76
Valley.....	5, 6, 8, 9, 13, 26, 28, 30
Kakwa Mt. and camera stations.....	69, 128
Mistanusk creek.....	134, 136, 137, 138
Mons.....	11
Monuments	
Bolts and cairns.....	125
Descriptions.....	94 to 98, 117
In passes	
Crownsnest (Phillipps).....	171, 183, 184
Miette.....	75, 76, 173, 175, 184, 185
Robson.....	74, 75, 173, 175, 183, 184
Initial monument on 120th Meridian.....	101
Intervisibility.....	125
Markings on.....	97
Memorial monument.....	77
Number built	
1918.....	101
1919.....	102
1922.....	114
1923.....	118
Perpetuation of.....	91
Sites.....	91
On 120th meridian in	
Township 56.....	57, 65, 71, 93, 97, 124, 126, 130, 177, 182, 185
57.....	97, 128, 177, 185
58.....	97, 177, 185
59.....	71, 97, 177, 185
60.....	97, 129, 177, 186
61.....	90, 97, 177, 186
62.....	97, 125, 129, 139, 178, 186
63.....	97, 134, 178, 186
64.....	97, 136, 178, 186
65.....	97, 137, 178, 187
66.....	93, 97, 139, 178, 187
67.....	97, 136, 141, 178, 187
68.....	97, 142, 178, 187, 188
69.....	97, 143, 178, 188
70.....	97, 144, 178, 188, 189
71.....	97, 145, 179, 189
72.....	97, 146, 179, 190
73.....	89, 97, 105, 147, 179, 190
74.....	97, 102, 148, 179, 191
75.....	97, 149, 179, 191
76.....	97, 150, 179, 192
77.....	97, 151, 179, 180, 192, 193
78.....	97, 102, 152, 180, 193
79.....	97, 102, 153, 180, 193
80.....	97, 155, 180, 193
81.....	97, 156, 180, 193, 194
82.....	97, 102, 156, 180, 194
83.....	97, 158, 180, 194, 195
84.....	33, 90, 97, 102, 116, 159, 180, 195
85.....	97, 160, 180, 195
86.....	97, 161, 180, 181, 195
87.....	97, 162, 181, 195
88.....	97, 120, 163, 181, 195

Index

	PAGE		PAGE
Monuments (<i>concluded</i>)		Passes (<i>concluded</i>)	
89.....	97, 164, 181, 195	Kicking Horse.....	85, 108
90.....	97, 165, 181, 195	Loren Lake.....	34, 39, 47, 48, 49
91.....	97, 165, 181, 195	Miette...5, 8, 9, 24, 26, 27, 51, 58, 59, 74,	
92.....	97, 166, 181, 195	75, 76, 86, 91, 124, 173, 175, 184	
93.....	97, 167, 181, 195	Moose.....	2, 6, 13, 14, 26, 27, 51, 75
94.....	97, 167, 181, 195	Morkill.....	34, 42, 50, 59, 71
95.....	97, 168, 181, 195	Phillipps.....	90, 124, 171
96.....	97, 168, 181, 195	Robson.....	6, 15, 19, 27, 28, 29, 58, 59,
97.....	93, 97, 169, 181, 195	74, 75, 77, 91, 92, 124, 173, 175	
Moonlight creek.....	158, 159	Shown on Alpine Club's Map.....	7
Moren Mt. camera station.....	11	Upright.....	8, 13
Moose		Wolverine.....	22
Lake.....	13	Yellowhead...1, 2, 3, 7, 9, 13, 16, 17, 24,	
Pass.....	2, 6, 13	28, 29, 58, 85, 90, 109, 127	
Pass crossing.....	26	Pauline	
Pass camera stations.....	15	Camera stations.....	33, 34, 48, 50
Valley.....	14, 27	Creek.....	34, 38, 40, 48, 50, 71
Morkill		Mt.....	40, 48
Camera station.....	62	Valley.....	38
River.....	41, 48, 49, 52, 60, 61	Peace river	
Pass.....	34, 42, 44, 50, 59, 71	Block.....	85, 150, 153
Mountain sheep.....	54, 114, 130	District river and valley...1, 7, 52, 85, 86,	
Mowat Mt.....	11	93, 97, 102, 103, 104, 113, 116, 118, 149,	
Muddywater river.....	34, 42, 54	154, 156, 157, 158, 159, 160, 161, 162, 163,	
Mummu peak.....	27, 75, 174	168	
Muskeg...120, 138, 140, 141, 142, 144, 147,		Town.....	103, 104, 118
159, 165, 166, 167, 168		Perseverance Mt.....	46
Narraway river...69, 72, 112, 114, 115, 116,		Phillips D.....	17
124, 129, 131, 132, 133, 135, 137, 138, 139,		N. camera station.....	45
143		Mt.....	23, 27, 36, 43, 44
National parks.....	77, 84	Phillipps pass.....	90, 124, 171
Nelson Fort.....	118	Pigmy camera station.....	47
North Saskatchewan river.....	103	Pine river.....	99
Oasis camp.....	34	Pisgah camera station.....	15
O'Beirne Mt.....	24	Plateau camera stations.....	13
Observations for azimuth.....	92, 126	Pouce Coupé	
Omega hill.....	131, 132	River and valley...102, 144, 148, 149, 151,	
Omye camera station.....	68	152, 154, 155, 156	
Oshoru river.....	163, 164, 166	Town and settlement...100, 151, 152, 153	
Palix camera station.....	62	Precise levels...16, 93, 101, 127, 149, 150	
Parsnip river.....	104	Promenade camera station.....	68
Passes		Ptomaine camera stations.....	62
Avalanche.....	34, 38, 40, 41, 49	Radio.....	58, 126
Beaverdam.....	34, 38, 40, 43, 48, 49	Railways	
Bess...2, 6, 20, 21, 28, 30, 31, 33, 34, 35,		Canadian Pacific.....	85
36, 37, 45, 51, 58		Canadian National...2, 16, 21, 28, 51, 77,	
Campbell's.....	8	103	
Carcajou.....	22, 23, 34, 36, 43, 53	Edmonton Dunvegan, B.C.....	99, 153
Casket.....	58, 60, 61, 62, 63, 71	Grand Trunk Pacific.....	16, 27, 103
Colonel.....	5, 11, 12, 25, 34, 51, 75	Razorback.....	11, 24
Crow'snest.....	171	Reconnaissance work.....	1, 2, 3, 5
Fetherstonhaugh.....	35, 59, 60	Redwillow river...107, 108, 109, 142, 144, 145	
Forgetmenot.....	59, 60, 71	Redband camera station.....	62
Fraser.....	28	Reef glacier and camera station.....	26
Grant.....	5, 10, 11, 25, 26, 27, 75	Icefield.....	14, 29
Hanington.....	68, 69	Renshaw	
Howse.....	85	Creek.....	41, 48, 49, 51
Jackpine.....	2, 6, 34, 35, 45, 47	Mt. and camera stations.....	34, 50
Jarvis.....	2, 3, 33, 65, 66, 67, 71, 77	Resplendent	
Jones.....	34, 40, 50	Creek.....	13
Kakwa.....	64, 65, 70	Mt. and glacier.....	26
		Valley.....	26, 29

Index

	PAGE		PAGE
Resthaven		Talbot	
Icefield.....	38, 50, 51, 52, 53	Camera station.....	35
Mt. and camera station.....	34, 47	Geodetic station.....	34
Rink brook.....	24	Mt. camera station.....	62
Rio Grande.....	118, 124, 141, 144, 145, 146	Tatei ridge.....	27
Roads.....	99, 100, 148, 150	Tecumseh Mt.....	172
Robson		The Emperor Falls.....	18
Cirque.....	18	The Emperor's Leap.....	18
Glacier.....	18, 23	The White Falls.....	18
Group.....	21	Ties to D. L. Surveys. 1, 94, 100, 127, 137,	
Mt. 2, 3, 6, 7, 15, 16, 17, 19, 26, 31, 50,		143, 147, 149, 150, 153, 155, 156, 159, 164	
58, 78		Titcana peak.....	173
Mt. Park.....	7, 30	Torrens	
Mt. Station.....	16	Camera stations.....	70
Pass. 6, 15, 19, 27, 28, 29, 58, 59, 74, 75,		Mt. 33, 57, 58, 68, 69, 70, 71, 72, 86, 90,	
77, 91, 92, 124, 173, 175		111, 113, 114, 115, 117, 124, 129, 131, 182	
River and valley.....	16, 17, 18, 19, 27	River.....	68, 69, 71, 72, 129
Rolla.....	155, 156	Trails	
Royal Canadian Air Force.....	2	Adskwatim.....	167, 168, 169
Ruth, Mt. and camera station.....	68	Bess pass.....	20, 21
		Big Shale Hill.....	34, 71
Salient Mt. and camera station.....	11	Calahoo.....	110, 115, 138, 140, 141, 142
Saxons		Cecil lake.....	163
Creek.....	67, 71, 72, 124, 129, 131	Chinchaga.....	169
Ridge.....	131	Chown creek.....	28
Seasons		Chown creek and Bess pass.....	51
1918.....	99	Colonel creek.....	5, 27
1919.....	101	Edson to Grande Prairie.....	103
1920.....	104	Fort St. John.....	162
1922.....	108	Fritton lake to Hythe.....	147
1923.....	116	Grande Prairie to 120th Meridian.....	99
1924.....	124	Grant pass.....	10
Sergeant creek and valley.....	102, 152, 153, 154	Miette river.....	27
Shale hills.....	34, 73, 74	Moose pass.....	27
Sheep		Robson pass.....	27, 28
Camera stations.....	62, 68	Robson station to Smoky river.....	50
Creek. 54, 55, 57, 58, 59, 61, 62, 63, 64		Smoky river.....	26
70, 71, 72, 73, 74, 112, 125, 128, 130		Smoky river to Jackpine valley.....	36
Pass.....	59, 61, 62, 66, 91, 124, 128	Yellowhead pass.....	27
Sir Alexander Mt.....	3, 4, 65, 66, 67, 129	Yellowhead pass to Smoky river.....	9
Sixth Parallel of Latitude.....	83, 123	Treadmill camera stations.....	15
Slave river.....	104	Triangulation. 1, 2, 3, 11, 33, 35, 58, 98, 124,	
Smoky		125, 126, 127	
River. 2, 6, 13, 15, 19, 20, 22, 26, 27, 28,		Trinity camera station.....	11, 24
36, 37, 42, 50, 51, 55, 104, 112, 148		Tupper river.....	149, 150, 151
Valley.....	2, 6, 15, 26, 28, 30, 36, 37	Upright	
Snake Indian river.....	8, 11, 13, 30, 50, 58	Camera station.....	15
Snaring river.....	5, 9, 10, 11, 13, 25, 27, 28	Creek.....	13, 14
Spider creek and camera stations.....	46	Mt.....	14
Spirit river.....	100, 153, 155	Pass.....	8, 13
Sprague camera station.....	35, 62	Valley of a Thousand Falls.....	16
Steeprock creek.....	146, 147	Vancouver Island.....	83
St. John sectional map.....	162	Vermilion chutes.....	104
Steppe		Fort.....	104, 124
Creek and valley.....	6, 13	Wallbridge Mt. and camera stations.....	64, 68
Glacier.....	14, 16	Wapiti river and valley. 69, 89, 93, 97, 109,	
Stonybend camera station.....	15	110, 111, 112, 113, 114, 115, 117, 124, 127,	
Stonyside camera station.....	15	131, 133, 134, 137, 139, 140, 141, 142, 144	
Sulphur river.....	50	Wapumun lake.....	65
Surprise lake.....	64	Weenusk.....	118
Swan lake.....	99, 148, 149, 150	White Falls.....	118
Swanson camera station.....	50	Whitehorn Mt.....	16, 23, 43, 44
Swank station.....	11		

I n d e x

	PAGE
Whiteshield Mt. camera station.....	45
Whistler camera stations.....	34, 47
Wolverine	
Camera stations.....	6, 23
Mt.....	23
Triangulation station.....	6
Pass.....	22

	PAGE
Yellowhead	
Lake.....	28, 31
Pass.....	1, 2, 3, 7, 9, 13, 16, 17, 24, 28, 29, 58, 85, 90, 108, 127

